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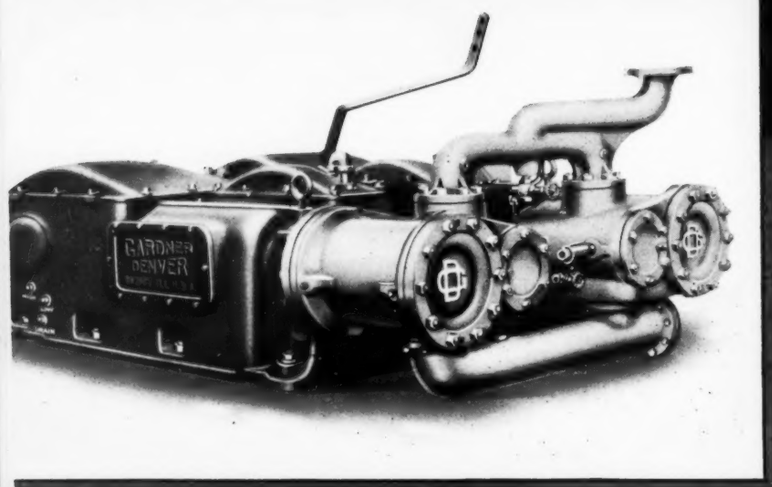

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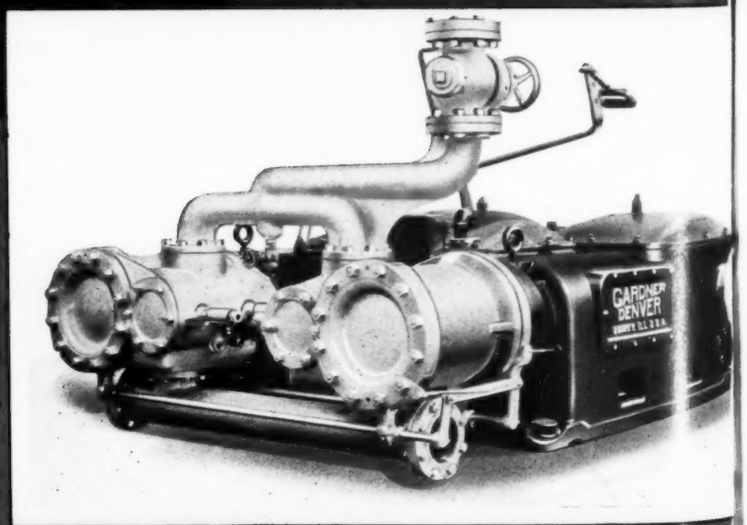

14 x 12 "Standard" Steam Drilling Engine

CONTINENTAL EMSCO

JULY
1936

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Rig Silhouetted Against the Dawn at Signal Hill, California

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PETROLEUM

Situation Bettered

IN THE American crude oil market a situation that was nothing short of critical a month ago has since shown improvement in several important respects. At the earlier date there were two definite sore spots in production, one in the Rodessa field in Louisiana and the other in California. A cut in the price of crude not only was threatened but was actually imminent at one time. Through the action of the California producers in checking the rise in output, supported by the major companies with purchases of distress gasoline, a break in the market was avoided. In Rodessa the situation was relieved by the order of the state authorities revoking special permits allowing capacity production of wells on the Pelican lease, this action being taken in response to the demand from the oil industry itself. In other states prominent independent producers have stressed the importance of holding production to the estimates published by the United States Bureau of Mines.

These developments are indicative of two things. As a result of persistent efforts to strengthen the hands of state proration authorities and to improve the application of proration laws the state commissions are in a better position than formerly to enforce their orders. Secondly, and equally important, sentiment among producers themselves more widely and strongly supports equitably applied control. Oil producers have learned that they are the greatest sufferers through overproduction.

While crude production has not been greatly reduced in the past few weeks it has been brought below the figure of 3,000,000 bbl. daily which was being exceeded during May. Moreover the change in trend has removed the danger and the irritation caused by a constantly rising output from week to week. Actually crude stocks at the end of June are some 10,000,000, bbl. less than a year earlier.

▼

Stocks Decline

IT WAS not merely the production of crude that caused serious concern a month ago. Mounting stocks of gasoline which had risen to record proportions were a source of anxiety. Beginning with the second week in June these stocks have been declining. In the two weeks ending June 27 stocks of gasoline at refineries and in storage decreased over 2,000,000 bbl. and with the season of heaviest demand for motor fuel at hand further drafts upon stocks in storage are to be expected. As various commentators have pointed out the question whether or not stocks in storage are excessive can be answered only by measuring them against current demand. On this basis the 61,720,000 bbls. held on June 27, this year represented only 46 days' supply while a year ago, on the same basis, stocks were sufficient for 44 days' supply for the whole country.

Another factor that has contributed toward making the market situation less hazardous has been a large volume of exports. During the first four months of 1936 total exports amounted to 37,971,000 bbl., an increase of nearly 14 percent over the corresponding period of 1935 which itself was a year of heavy export movement. While exports are of minor importance compared to domestic movements they have served as a substantial balance wheel in this particular situation.

All in all the record of the oil industry during the first half of the current year, despite the difficulties that have arisen at times, has been a satisfactory one and the outlook at the present time is most encouraging.

▼

Japan Seeks More Oil

IN THE petroleum industry as in the political field special interest is centered on the Far East and particularly upon the activities of Japan. While recent reports from Tokyo that the government had adjusted its differences with British and American companies operating in Japan over the question of storage requirements are not fully borne out by later advices there are numerous indications that the Japanese authorities have attacked with renewed energy the problem of acquiring control of oil supplies sufficient to meet military and naval needs in the event of war.

This purpose undoubtedly lies behind the intensified drive for exploration in Korea and other parts of the Empire, the expansion of activity in the utilization of shale deposits in Manchukuo and the formation of a combine of Japanese companies, presumably inspired by the government, to acquire outside production. Another angle of the situation is provided by negotiations with the Soviet Union over renewal of the Sakhalin agreement, though from the military viewpoint this is not particularly important since Japanese strategists anticipate no difficulty in seizing this source of supply if hostilities occur.

Alf. M. Landon—Typical Oil Man

NOMINATION for the Presidency of Alfred M. Landon, Governor of Kansas, is of special interest to members of the petroleum industry because the Governor's business activities from the time he started work have been devoted to oil production and because this is the first time in the history of the United States that an oil man has become a candidate for the nation's highest office.

Popular fancy seems to picture all oil operators as millionaires but Governor Landon is not one of this class. He is regarded by his friends and neighbors as being comfortably well to do but he belongs to the group of small operators which is by far the largest numerically in the industry. His interests and affiliations have been always with the small independents and he has been for several years a director of the Independent Petroleum Association. He is a typical midwestern oil man as well as Governor of a "typical prairie state."

Governor Landon's first job was as a member of a construction gang building the Gulf Pipe Line from the Glenn pool. In his early twenties he got into production on his own account in a small way. His first operations were in the Osage country in Oklahoma and in Montgomery County, Kansas. Later he was identified with the development of production in Greenwood and Elk Counties, Kansas. His residence and business headquarters have been maintained in his home town of Independence where he occupies small offices in the building of the Citizens Bank.

Governor Landon has owned some average Kansas wells but never any of large production. His wells are the kind whose existence is imperiled when prices are forced to a low level by uncontrolled flush production. Consequently he has been interested in conservation that would hold production reasonable in balance with demand. He has confined himself to the producing side of the industry except for joining with neighboring owners in the construction of a small gathering system in one of the Kansas fields. His viewpoint may fairly be said to be that of thousands of individual operators who look to the oil industry as a means of gaining a livelihood or at most a modest competence.

The Governor's opinions regarding oil industry regulation have been expressed on numerous occasions. A fair summation of these views appears in a letter which he addressed to the chairman of the subcommittee of the Senate Committee on Mines and Mining in February 1935. In that letter his platform, if so it may be called, was stated in the following terms:

"1—That the states by voluntary independent action and practical, informal cooperation, or otherwise, or by state compact, always be given first opportunity to fix proper quotas for themselves and to enforce them.

"2—That the Federal government aid the states in this endeavor by lending its powers in controlling storage withdrawals and imports, which the states concededly cannot do.

"3—If the states fail to make and enforce proper allocations, that then the Federal government do that necessary job."

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Alfred M. Landon

The letter in which the above passage appears was written in advocacy of the Disney bill then before Congress. Later Governor Landon's limited approbation of federal regulation appears to have lessened still further as did that of the majority of oil men as a result of their experiences under the NRA. In an interview published in October 1935 he explained that his support of federal control had been due to his strong conviction of the necessity of preventing waste of a great natural resource. He added:

"I am strongly opposed to Federal encroachment upon the rights and powers of the states. I oppose bureaucratic control of any industry. . . . The oil industry in the oil-producing states has an opportunity for cooperation under the interstate compact which never before existed. Taking full advantage of this opportunity and sincerely cooperating, one with the other, to solve the problems of the petroleum industry will assure this business of self-government and the elimination of any form of Federal bureaucratic control."

In this expression too, Governor Landon spoke as a typical representative of the rank and file of oil men in the United States.

Politics has not dimmed the Kansas Governor's interest in the industry with which he has been so long identified. It is told that early in the present year, when it appeared probable that he would become the Republican candidate for President, he was asked whether he was willing to have his name presented for re-election to the board of directors of the Independent Petroleum Association. His reply was that he would be glad of re-election because he intended to maintain an active interest in petroleum affairs.

▼

AS A result of the change in Canada's import tariff, the Standard Oil Company of California has decided not to build a refining plant in Saskatchewan.

Five Year Financial Records

Financial Results of Past Half Decade Reflect Gradual Improvement in Petroleum Industry. Refunding Operations and Surplus Accumulations Strengthen Position. *By Henry E. Rose*

By comparison with the five years immediately preceding it, 1935 was a good year for oil company operations. Looking over the reports of twenty-three representative American companies it is noted that each one was able to show something in the way of net earnings last year, whereas in 1934 four still had deficits. In 1933 and 1932 the number operating at a loss was eight, while in 1931 it was thirteen or more than half the total number.

In 1935 the net income of these twenty-three companies was a little over $275,000,000. In 1933 their operations were conducted at a loss of $7,500,000 and in 1931 their deficit was over $91,000,000. While net in 1935 showed a gain of 40 percent over the preceding year it was still much below 1929. Ten of the principal American companies earned $193,000,000 last year, but in 1929 the same companies had profits of $476,000,000 or two and one half times as much. While the industry has come back a long way from the depths of 1931–32 it still has a great distance to go to equal its record of 1929. While the aggregate earnings last year of the American companies listed in the accompanying tabulation formed an impressive aggregate, the really modest proportions of their income is shown by the fact that it averaged only $1.50 on the common shares of the various companies.

While the improvement in the financial showing of oil companies during the past three years reflects in part the increase in general business activity, it has been helped also by factors confined to the oil industry itself. One of these has been the more effective application of proration in oil producing, notably in the state of Texas which is an oil empire in itself. Another has been the prevalence of more stable marketing conditions. Still another has been the extensive refunding operations carried through by many companies to take advantage of lower interest rates and thereby reduce their fixed charges.

These refunding operations naturally have effected the largest savings for major companies of large capital structure, though proportionately they have been equally important for some of the smaller companies. Among recent examples of such readjustments has been the offering by Standard Oil Co. (New Jersey) of $85,000,000 of three percent debentures to provide for the retirement of five percent guaranteed preferred stock of Standard Oil Export Corporation, preparatory to the dissolution of the latter company.

Shell Union Oil Corporation offered $60,000,000 of 3½ percent debentures to provide for repayment of approximately $23,000,000 of five percent gold debentures and about $24,000,000 of similar debentures of its subsidiary, Shell Pipe Line Corporation. The Texas Corporation, a few weeks ago, sold $60,000,000 of 3½ percent debentures to retire a similar amount of sinking fund debentures, the new issue quickly going to a premium, a significant indication of the estimate which investors place on high-grade oil securities.

Consolidated Oil Corporation, after substituting bank loans of $40,000,000 for some of its fixed interest securities in order to take advantage of lower interest rates, proposes to convert this obligation into an issue of $50,000,000 debentures, carrying probably 3½ percent interest, which at the same time will provide $10,000,000 additional working capital.

Earlier in the year Atlantic Refining Company sold some $14,000,000 of cumulative preferred stock carrying a four percent rate to retire a corresponding amount of 15-year five percent gold debentures due July 1, 1937. Skelly Oil Co. sold $3,000,000 of serial notes at a low interest rate and $9,000,000 of four percent debentures to retire $9,150,000 of 5½ percent sinking fund debentures and to provide additional capital for corporate purposes.

In the aggregate these refunding operations, of which only the more recent have been mentioned here, have the effect of reducing by some millions of dollars the interest charges of the companies concerned, thereby enhancing the attractiveness of their common or preferred shares and putting them in a stronger position to meet possible unfavorable developments in the future. Since many of these operations have been put through since the beginning of 1936 their effect will be reflected in future balance sheets.

Another respect in which the improvement in earnings has enabled oil companies to strengthen their position is in additions to surplus. During the difficult years of 1931 and 1932 surplus accounts were drawn upon by many companies to maintain operations. Beginning in 1933 surpluses have been gradually replenished and particularly notable additions were made in 1935. While not all companies increased their surplus funds, the twenty-three American companies referred to earlier made net additions of $128,525,000 to this account. What effect the new tax law penalizing surplus accumulations will have on future appropriations remains to be seen, but the natural expectation is that they may result in a larger share distribution with less laid aside for the inevitable rainy day.

Outside the United States leading companies have shown the same general improvement in net operating results, but with less fluctuation in earnings from year to year. This difference is accounted for probably by the fact that the consumption of petroleum products increased continuously throughout the period of depression, while in the United States there was an actual falling off in demand in 1932 and 1933. Among the British companies the earnings of Burmah have fluctuated somewhat with the vicissitudes of the Indian market. It is noteworthy, however, that the income of a strictly independent company like Trinidad Leaseholds has shown accretion in about the same ratio as the larger companies that operate in close association.

Assets of British companies have not increased comparably with the profit advance, asset values having been depreciated regularly out of profits on a very strict basis. This accounts for the low book value of most of the company shares.

Few major capital operations have been effected by British oil concerns during recent years, redemption of £4,000,000 of 5½ percent debenture stock by Burmah and £4,850,000 of five percent debentures by Anglo-Iranian being the two most notable transactions. Carried through in

1934, these repayments of debentures were made from the respective companies' current liquid resources. They are reflected in the heavy decline shown in the working capital of each undertaking between the years 1933 and 1934, resulting from the repayment of debentures, a long-term debt, by the use of current disposable assets. Even after this depletion, however, net working capital of Anglo-Iranian remained at over £4,000,000 and Burmah had £6,232,000 net working resources. A notable reduction in the working capital of Lobitos also took place between 1932 and 1934, reflecting the use of the company's cash and investments for completion of the Ellesmere Port refinery.

In addition to its debenture redemption, Burmah issued a capital bonus of one share in three in 1934, an operation which was largely responsible for the decline in earnings per £1 of capital from 5s. 1.3d (25.5 percent) in 1933 to 3s. 0.7d (15.0 percent) in 1934.

Accounts for 1935 of British producing and distributing companies generally have shown a relatively large profit increase, reflecting the strengthening of the world oil situation. The abstract of their figures shows them to be well placed financially for any further expansion of business. Assets of all the major companies are valued at extremely conservative levels, due to generous depletion allowances over many years, and none of those included in the accompanying table has any debenture debt outstanding.

Judging from operating results for the first half of the current year, 1936 reports will reveal earnings equal and in many cases somewhat exceeding those of 1935. While marketing conditions in certain areas are still unsatisfactory, the increased volume of business resulting from the growth in consumption of petroleum products should lead to a continuation of upward progress.

In the accompanying tabulation are shown net income, share earnings on common shares, net working capital, net capital assets (property, plant and equipment after reserves for depreciation and depletion) funded and/or long term debts and surplus accounts of leading companies of the world for the past five years. This recapitulation reveals rather clearly the financial progress of the oil industry.

Five Year Financial Review — Companies Outside U. S.

	Net Income	Percent of Ordinary Shares	Net Working Capital	Net Capital Assets	Total Ordinary Stock Equity	Book Value per Ordinary Share	Dividend per Ordinary Share
Anglo-Iranian Oil Co. Ltd.		s. d.					s. d.
1935	£3,519,000	3 7.8	£5,859,000	£44,809,000	£23,748,000	£1.77	3
1934	3,185,000	3 1.8	4,052,000	45,625,000	24,058,000	1.79	2 6
1933	2,644,000	2 4.1	7,269,000	48,539,000	23,654,000	1.76	1 6
1932	2,380,000	1 11.4	7,082,000	50,281,000	23,391,000	1.74	1 6
1931	2,319,000	1 11.2	5,198,000	45,736,000	23,128,000	1.72	1 0
Burmah Oil Co. Ltd.							
1935	£2,277,000	4 5	£6,219,000	£20,781,000	£14,259,000	£1.56	4
1934	1,657,000	3 0.7	6,232,000	19,928,000	13,400,000	1.46	3
1933	2,012,000	5 1.3	10,327,000	24,006,000	13,613,000	1.49	3 6
1932	1,524,000	3 8.5	9,269,000	23,553,000	13,019,000	1.90	4
1931	1,869,000	4 8.9	7,315,000	23,266,000	12,737,000	1.85	3 6
Lobitos Oilfields Ltd.							
1935	£ 42,000	10.2	£ 375,000	£ 3,277,000	£ 3,108,000	£3.10	1 6
1934	63,000	1 3.1	395,000	3,184,000	3,120,000	3.12	1 6
1933	29,000	6.9	560,000	3,125,000	3,133,000	3.13	2 0
1932	112,000	2 3	667,000	3,423,000	3,188,000	3.19	2 6
1931	114,000	2 3.3	622,000	3,167,000	3,167,000	3.17	2 6
N. V. Koninklijke Nederlandsche Maatschappij (Royal Dutch Co.)							
1935	Fl. 54,279,189	10.77	Fl. 133,183,000	Fl. 749,371,000	Fl. 627,806,000	1 247	†10.5
1934	38,131,575	7.56	99,079,000	695,596,000	600,669,000	1 193	7.5
1933	30,546,307	6.05	117,192,000	706,556,000	608,816,000	1 197	6.0
1932	28,303,691	5.62	43,363,000	705,759,000	601,546,000	1 194	6.0
1931	27,916,648	5.54	47,280,000	707,215,000	602,514,000	1 196	6.0
Shell Transport & Trading Co.		s. d.					s. d.
1935	£5,021,246	3 6	£15,336,000	£49,305,000	£36,856,000	£1.53	‡3 6
1934	3,807,475	2 6	13,971,000	48,095,000	35,650,000	1.48	‡2 6
1933	2,748,035	1 7	12,610,000	46,884,000	34,451,000	1.43	‡1 6
1932	2,661,457	1 7	17,069,000	46,721,000	34,312,000	1.42	‡1 6
1931	2,557,258	1 5	11,438,000	46,674,000	34,260,000	1.42	‡1 6
Trinidad Leaseholds, Inc.*		s. d.					s. d.
1935	£ 240,000	3 7.9	£1,152,000	£ 3,060,000	£ 2,558,000	£1.95	3 6
1934	164,000	2 6.1	798,000	2,921,000	2,479,000	1.89	2 6
1933	197,000	3 0	777,000	2,995,000	2,513,000	1.92	3 0
1932	195,000	2 11.6	668,000	2,840,000	2,476,000	1.89	2 6
1931	D 7,000		413,000	2,760,000	2,405,000	1.83	1 0

* Years ending June 30 † Shares of 1,000 Florins ‡ Free of income tax

Five Year Financial Review — U. S. Oil Companies

Amerada Corp.	Net Income	Per Share of Com.	Net Working Capital	Net Capital Assets	Funded and or Long Term Debt	No. of Pref. Shares	No. of Com. Shares	Surplus
1935	$ 1,797,613	$2.28	$ 5,008,667	$ 9,227,589	$	.....	788,675	$3,826,392
1934	1,736,420	2.20	5,096 673	8,966,293	.....	.....	788,675	3,606,129
1933	380,443	.50	4,942,424	8,576,743	.....	.....	767,375	3,424,559
1932	1,147,207	1.48	7,328,270	7,692,714	.....	.....	774,875	4,609,669
1931	d 1,701,648	...	6,762,882	8,555,916	.....	.....	766,275	5,283,874
Atlantic Refining Co.								
1935	3,970,598	1.49	36,512,103	111,157,824	14,023,623	.....	2,664,901	65,617,388
1934	5,512,105	2.07	37,960,843	109,739,314	14,024,734	.....	2,664,902	66,791,823
1933	6,556,377	2.46	30,015,187	104,489,510	14,046,793	.....	2,665,234	64,202,597
1932	3,918,021	1.45	34,945,032	107,179,944	14,070,793	.....	2,696,642	61,144,504
1931	513,750	.19	35,285,503	106,607,650	14,594,739	.....	2,696,642	60,286,415
Barnsdall Oil Co.								
1935	741,136	.34	2,152,780	7,659,141	.....	.....	2,131,090	7,256,270
1934	d 1,029,447	...	3,719,365	14,968,355	318,510	.....	2,205,451	9,096,713
1933	d 1,942,635	...	3,760,360	15,522,433	.....	.....	2,258,779	10,695,191
1932	d 847,072	...	2,915,649	17,246,832	.....	.....	2,258,779	12,693,772
1931	d 3,268,637	...	3,692,339	49,610,291	88,100	.....	2,258,779	1,583,734
Consolidated Oil Corp.								
1935	11,306,904	.74	78,377,440	200,965,255	40,181,938	106,028	13,983,237	180,540,203
1934	553,282	e 5.43	75,099,378	208,402,801	47,343,015	101,844	13,996,172	175,399,041
1933	133,580	e 1.28	92,983,007	204,832,796	53,790,823	104,144	14,025,551	176,234,473
1932	b 1,601,039	.05	101,923,567	210,840,320	59,528,643	111,594	14,218,835	189,656,802
1931	d 22,010,172	...	c 119,056,353	214,444,482	64,231,473	129,694	14,218,835	189,980,527
Continental Oil Corp.								
1935	8,813,561	1.88	31,154,643	39,825,881	.....	.....	4,682,664	56,880,127
1934	4,865,358	1.03	25,390,339	40,647,154	.....	.....	4,738,593	51,780,703
1933	2,275,860	.48	29,628,797	41,922,070	8,025,409	.....	4,738,593	48,549,652
1932	d 1,444,133	...	27,277,384	42,776,264	9,546,263	.....	4,738,593	45,504,505
1931	d 12,045,575	...	23,922,822	99,197,042	10,614,638	.....	4,743,924	30,326,314
Creole Petroleum Corp.								
1935	5,509,067	.79	8,229,979	52,877,364	.....	.....	6,974,356	27,357,909
1934	5,315,254	.76	5,174,439	51,926,430	.....	.....	6,974,356	22,657,566
1933	4,106,099	.59	3,356,137	52,792,289	.....	.....	6,974,356	22,102,453
1932	2,075,403	.30	3,342,909	50,222,565	.....	.....	6,974,356	d 4,018,368
1931	d 4,510,465	...	2,475,210	48,089,250	.....	.....	6,974,356	d 7,139,027
Gulf Oil Corp.								
1935	10,551,720	2.32	96,410,624	288,757,680	87,166,000	.....	4,538,101	199,049,566
1934	2,811,183	.62	97,615,006	283,076,187	91,629,847	.....	4,538,101	189,737,492
1933	d 11,386,387	...	90,174,574	276,725,868	102,462,863	.....	4,538,101	190,155,467
1932	2,743,492	.60	96,748,097	285,494,570	110,463,195	.....	4,538,101	195,567,278
1931	d 23,670,052	...	98,058,836	596,196,804	125,559,392	.....	4,525,221	195,676,193
Humble Oil & Refining Co.								
1935	23,966,326	2.66	29,002,746	204,138,789	487,610	.....	9,000,000	53,499,275
1934	21,989,954	2.45	31,580,204	193,059,994	6,831,050	.....	8,968,479	38,078,401
1933	20,847,817	2.32	46,952,934	179,020,501	18,950,000	.....	8,985,666	132,405,573
1932	14,896,613	1.65	45,123,591	167,504,927	18,950,000	.....	8,985,666	117,589,683
1931	2,765,092	.93	66,295,168	162,482,937	42,944,000	.....	2,974,645	109,567,972
Imperial Oil, Ltd.								
1935	25,229,850	.94	72,607,155	53,572,421	.....	.....	26,965,078	89,211,976
1934	25,771,653	.96	69,055,219	58,520,697	.....	.....	26,919,871	97,678,704
1933	14,101,561	.52	49,243,315	65,053,656	.....	.....	26,857,152	110,645,191
1932	14,713,238	.55	49,310,547	69,883,456	.....	.....	26,783,092	109,958,799
1931	18,226,894	.68	60,278,383	a 121,050,292	.....	.....	26,742,792	108,584,328
Mid-Continent Petroleum Corp.								
1935	2,417,175	1.31	17,132,369	36,662,598	.....	.....	1,857,912	38,311,091
1934	828,093	.45	15,133,343	36,947,518	.....	.....	1,843,872	36,893,649
1933	d 1,766,438	...	14,779,310	50,559,281	.....	.....	1,857,912	13,174,089
1932	d 2,081,900	...	14,034,087	53,942,030	.....	.....	1,857,912	14,971,218
1931	d 4,962,411	...	14,832,082	54,949,054	.....	.....	1,857,912	17,032,576
Ohio Oil Co.								
1935	5,488,267	.33	32,155,437	k 93,314,153	.....	548,077	6,563,377	17,915,323
1934	5,411,924	.32	33,740,981	k 95,599,183	.....	580,943	6,648,052	10,789,515
1933	d 133,016	...	32,438,578	99,028,129	.....	580,943	6,648,052	11,672,319
1932	7,242,981	.58	27,942,774	k 100,050,004	.....	580,796	6,648,052	17,365,680
1931	d 21,488,763	...	26,460,602	k 99,232,312	.....	580,668	6,648,052	17,046,670
Phillips Petroleum Co.								
1935	13,421,703	3.23	23,450,267	137,258,621	20,945,221	.....	4,152,836	21,954,036
1934	5,757,308	1.38	21,601,235	136,992,626	26,393,309	.....	4,153,235	13,721,113
1933	1,500,695	.36	19,652,248	141,510,522	29,983,963	.....	4,154,687	12,116,812
1932	775,766	.18	13,579,510	149,656,040	33,329,962	.....	4,153,104	10,616,117
1931	d 5,576,409	...	5,910,547	159,785,585	36,373,836	.....	4,165,295	25,079,333

Pure Oil Co.	Net Income	Per Share of Com.	Net Working Capital	Net Capital Assets	Funded and/or Long Term Debt	No. of Pref. Shares	No. of Com. Shares	Surplus
1935	$ 8,150,026	$2.00	$24,685,287	$110,753,615	$38,743,113	309,000	3,038,700	$41,728,169
1934	d 884,872	...	12,175,503	108,456,105	28,500,000	300,270	3,038,700	34,768,621
1933	811,086	g 2.75	12,804,584	102,602,376	30,500,000	300,270	3,038,700	35,766,659
1932	642,386	g 2.14	12,866,311	104,397,973	32,500,000	300,270	3,038,700	35,075,043
1931	h 470,177	g 1.56	14,465,131	175,219,429	34,500,000	300,000	3,038,700	59,268,846
Seaboard Oil Co.								
1935	1,670,847	1.34	2,149,116	5,660,271	.....	.....	1,244,383	1,843,158
1934	1,375,590	1.10	2,323,826	5,523,004	.....	.....	1,244,383	1,416,694
1933	1,275,565	1.02	2,826,454	5,460,401	.....	.....	1,244,383	1,285,487
1932	858,172	.71	2,103,481	5,459,451	.....	.....	1,244,383	763,842
1931	123,711	.10	1,939,568	5,173,296	.....	.....	1,244,383	d 3,479,627
Shell Union Oil Corp.								
1935	6,812,835	.37	41,353,931	261,648,294	50,153,979	388,166	13,070,625	3,419,589
1934	d 949,111	...	39,068,934	260,050,464	53,581,227	400,000	13,070,625	d 18,435,042
1933	d 5,250,290	...	56,784,051	270,029,142	81,540,451	400,000	13,070,625	d 17,081,141
1932	d 4,288,496	...	59,651,206	285,784,252	96,190,376	400,000	13,070,625	d 12,840,176
1931	d 27,008,310	...	70,281,199	532,645,336	127,077,204	400,000	13,070,625	d 12,501,109
Skelly Oil Co.								
1935	2,585,849	2.16	5,946,672	33,260,799	8,756,859	66,300	1,008,548	9,335,556
1934	713,577	.30	5,841,952	31,527,488	9,615,679	67,000	1,008,548	d 2,745,942
1933	d 1,107,661	...	7,956,075	29,563,306	9,814,000	74,800	1,008,548	d 3,795,193
1932	d 1,043,682	...	8,059,963	32,824,685	10,935,500	94,300	1,008,548	d 4,173,036
1931	d 2,117,110	...	7,610,693	35,723,862	11,912,000	114,000	1,011,753	d 5,086,730
Socony-Vacuum Oil Co., Inc.								
1935	22,525,892	.71	186,858,832	400,094,099	74,326,495	.....	31,708,456	146,736,060
1934	24,121,297	.76	184,148,471	400,204,514	85,014,584	.....	31,154,279	138,588,901
1933	22,545,462	.71	208,663,144	613,445,907	83,312,556	.....	30,905,006	55,866,705
1932	5,320,282	.17	238,259,829	j 672,149,125	88,687,021	.....	31,019,693	50,494,006
1931	d 4,169,248	...	259,073,230	j 699,314,437	99,355,586	.....	31,744,533	86,692,551
Standard Oil Co. of California								
1935	18,594,330	1.42	62,647,719	445,640,587	5,000,000	.....	13,102,900	212,453,308
1934	18,327,807	1.40	80,120,833	437,191,071	.....	.....	13,102,900	211,733,009
1933	7,560,903	.58	85,290,291	446,139,358	.....	.....	13,102,900	213,630,216
1932	13,994,992	1.07	80,711,983	458,666,507	.....	.....	13,102,900	223,272,323
1931	14,559,593	1.11	80,866,334	470,713,077	.....	.....	13,102,900	235,662,653
Standard Oil Co. of Indiana								
1935	30,179,895	1.98	170,876,326	366,184,636	10,579,963	.....	15,215,677	253,905,946
1934	18,949,680	1.25	182,889,895	275,715,684	8,413,670	.....	15,215,677	226,267,121
1933	17,674,351	1.14	192,298,854	306,632,853	7,677,413	.....	15,528,504	228,047,576
1932	16,558,282	1.04	203,452,389	308,881,744	37,140,256	.....	15,941,894	227,415,764
1931	17,596,396	1.04	214,897,728	481,715,520	48,229,461	.....	16,908,543	242,316,116
Standard Oil Co. (N. J.)								
1935	62,863,192	2.43	425,337,478	1,054,520,041	82,772,730	.....	25,856,081	448,127,942
1934	45,618,960	1.76	407,165,346	1,082,380,163	141,461,816	.....	25,856,081	449,062,205
1933	25,084,310	.97	407,177,198	1,060,449,508	179,398,236	.....	25,761,465	507,846,292
1932	282,865	.01	447,151,246	1,148,830,800	207,245,001	.....	25,740,965	520,556,406
1931	8,704,758	.34	585,238,363	1,129,910,915	173,442,017	.....	25,735,468	592,493,162
Standard Oil Co. of Ohio								
1935	2,690,647	2.77	11,245,428	34,427,880	741,915	120,000	753,740	15,275,632
1934	d 1,913,735	...	8,670,081	35,771,654	266,800	120,000	753,740	13,184,984
1933	d 823,357	...	10,600,970	34,619,520	305,855	120,000	753,740	15,945,709
1932	d 1,206,361	...	10,382,424	38,571,056	326,035	120,000	753,740	17,691,344
1931	2,359,173	2.34	11,383,276	41,106,597	395,731	120,000	752,467	21,096,018
Sun Oil Co.								
1935	7,100,239	3.45	20,043,466	62,787,994	6,675,681	100,000	2,030,988	9,512,101
1934	6,650,464	3.51	16,250,464	62,545,483	6,500,000	100,000	1,893,982	9,609,319
1933	6,971,844	4.04	18,134,634	60,640,679	10,541,000	100,000	1,576,697	10,778,750
1932	4,198,046	2.35	17,243,193	60,440,669	11,864,000	100,000	1,531,422	10,999,863
1931	3,107,147	1.63	16,325,540	60,207,448	12,131,000	100,000	1,535,456	11,502,220
Texas Corp.								
1935	17,065,037	1.83	125,756,164	257,074,288	93,253,676	.....	9,340,069	103,074,635
1934	5,545,205	.59	119,372,463	266,660,893	103,600,076	.....	9,349,733	103,232,978
1933	d 491,004	...	126,073,698	266,020,236	104,092,777	.....	10,352,371	111,612,512
1932	d 2,161,841	...	133,426,320	286,637,122	109,804,745	.....	10,486,368	134,352,282
1931	d 9,954,478	...	155,486,505	301,719,735	117,845,877	.....	10,851,237	150,866,663
Tide Water Associated Oil Co.								
1935	7,865,701	.73	33,682,501	117,806,258	19,774,335	626,221	5,642,342	21,336,760
1934	5,810,657	.35	41,220,500	113,226,094	2,504,892	636,222	5,631,341	20,620,669
1933	7,265,301	.61	43,241,327	114,383,792	9,280,790	643,023	5,618,672	20,967,673
1932	4,718,693	.13	37,765,931	119,982,364	13,218,754	666,524	5,611,040	13,694,604
1931	d 5,818,671	...	43,313,115	146,978,320	16,626,294	684,552	5,780,907	13,739,247
Union Oil Co. of California								
1935	5,038,286	1.15	35,545,741	108,543,534	21,526,500	.....	4,386,070	14,120,970
1934	2,902,733	.66	35,976,560	107,956,010	21,489,500	.....	4,386,070	13,914,222
1933	1,954,279	.45	42,640,151	139,738,680	26,687,000	.....	4,386,070	47,060,129
1932	3,211,084	.73	45,739,877	144,881,088	31,609,145	.....	4,386,070	50,673,657
1931	3,054,913	.70	47,675,448	147,888,106	32,546,500	.....	4,386,070	55,028,849

(a) Before reserves for depreciation. (b) Eleven months ended December 31, 1932. (c) As of January 1, 1932.
(d) Deficit. (e) On preferred stock. (g) On $100 par combined 5¼, 6 and 8% preferred stocks.
(h) Year ended March 31, 1932. (j) Including good will, appreciation of properties, etc. (k) Exclusive of good will, patents, etc.

Japan's New Effort to Expand Oil Resources

Formation of a Combine Among Japanese Firms Interpreted as Preliminary to an Effort to Obtain Outside Production—Reported Settlement of Issue with Companies Marketing in Empire.

RECENT reports from Tokyo indicate that a special effort is in the making to develop additional petroleum production under Japanese control, or at least from dependable sources of supply if not in Japanese territory. For several years past the exploration of home areas has been pushed energetically but has not increased appreciably the proportion of domestic output in the total supply of the country which remains at approximately 20 percent. Now a move to extend and exploit crude production in Pacific areas outside the country is being made by leading Japanese oil concerns.

As a step in this direction, according to Japanese dispatches, the Mitsui Company, Mitsubishi Shoji Kaisha and the Sumitomo Company have formed a combination capitalized at Yen 50,000,000 or roundly $15,000,000, and preliminary expenses of Yen 1,000,000 have been authorized. These reports state further that the Mitsui Trading Company and the Borneo Oil Company have been producing an average of 13,600 bbl. per day during the past year under concessions in Borneo. The former is primarily a marketing concern but a consolidation of the two is reported to be planned as an initial step toward the larger combine referred to.

What success Japan may attain in the effort to gain a substantial place in the development of Pacific oil remains to be seen. As a late entrant in the race the Japanese find many of the most desirable positions preëmpted. The most prolific territory in the Far East is Netherland India. Here the largest unexplored areas are in Sumatra, Borneo and New Guinea. In addition to the extensive holdings of Royal Dutch subsidiaries and of the Netherlands Colonial Petroleum Company (Standard-Vacuum) a concession covering 1,500,000 hectares has just been confirmed to the Netherlands Pacific Petroleum Co., which is one of the corporations composing the newly organized California Texas Oil Co. Ltd. In New Guinea a concession covering 10,000,000 hectares, ultimately to be reduced to 1,000,000, is held by the Netherlands New Guinea Petroleum Co. in which the major interest is held by Royal Dutch with Standard-Vacuum and California Texas holding a minor share. The company is now engaged in an aerial survey and considerable time must elapse before it can define the territory in which it will elect to carry out its underground exploration.

In the regions where Japan is in control the prospect of discovering large petroleum deposits is not regarded as being particularly encouraging. At the time when Japanese influence was extended over Manchuria newspaper reports mentioned petroleum as one of the attractions in that area but aside from the extensive shale deposits which are now being worked to provide oil for Japan's navy, geologists do not anticipate the development of any important oil field. The same is true of North China where Japanese infiltration is now going on. A careful survey of Korea has been undertaken with results still to be determined.

Since the directors of Japanese policy consider it of the first importance to be as nearly self sufficient as possible in all the essentials of military and naval operations the search for oil within the limits of the Empire undoubtedly will be continued with unremitting vigor, but it seems probable that if this objective is to be attained the nation must rely principally on outside concessions to be obtained by purchase or development.

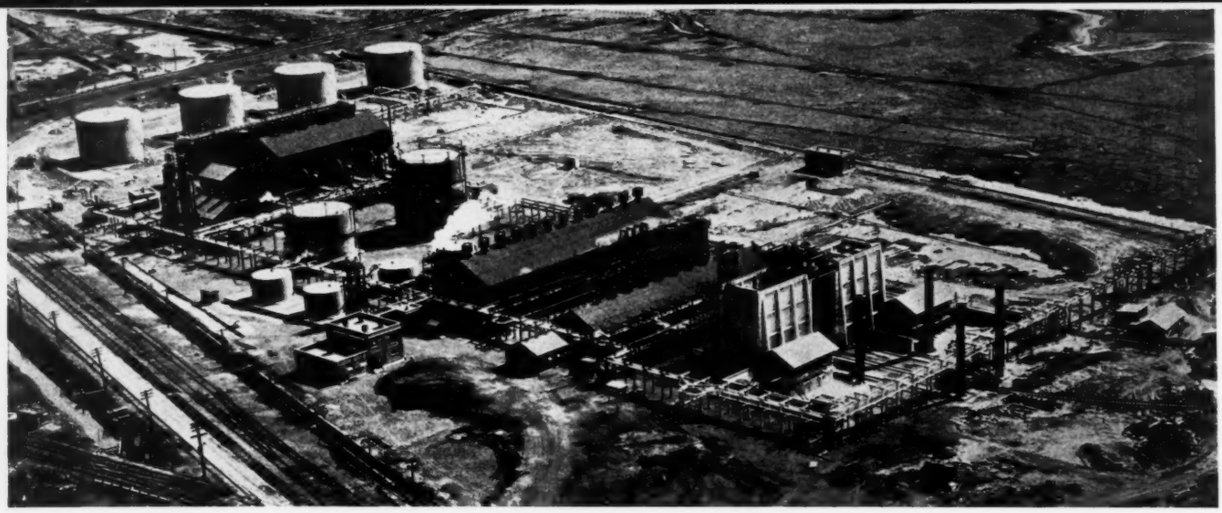
Another indication that Japan considers it desirable to consolidate its position in the matter of oil is contained in recent press reports that the differences between international oil companies operating in Japan and the government over the latter's requirement that the companies carry a six months' supply in storage have been settled. The contention of the companies has been that if storage of supplies in excess of ordinary trade demands is to be required they should have some remuneration for providing the extra facilities. The reports referred to state that to meet this claim the government has agreed to pay Yen 2,500,000 as annual interest on the investment in tanks and other storage facilities. While the oil companies decline to admit that an adjustment of this issue with the government has been reached it is evident that the Japanese authorities are now showing a disposition to end the long delay in settling the question.

According to private dispatches to Japanese exporters on the Pacific Coast, the Milham interests in control of the Seaboard Oil Company have contracted to supply the Ogura Oil Company of Japan 100,000 tons of Kettleman crude, to be delivered over a period of several months. This oil will come from Milham production at Kettleman Hills, part of which is sold under contract to The Texas Company. It was to provide an outlet for the remainder of the Milham production that the Texas-Seaboard pipe line is being built. Pending completion of this line about August 15, Seaboard supplied its first cargo on the Ogura contract by buying back some of its own oil sold to Associated Oil Co. This oil sold to Associated at the field, was bought back at Avon on the northern reaches of San Francisco bay and loaded on the Motor Tanker TATEKAWA MARU at Amarco near Avon. Future deliveries will be from the new Texaco-Seaboard marine terminal at Estero Bay.

▼

Saudi Arabian Well

STANDARD Oil Company of California announces that an oil well on its concession in Saudi Arabia has been brought in at a rate of 3,840 bbl. of 53 deg. gravity crude oil per day. This is the first commercial production in this field. The well, known as Dammam No. 2, is located on the mainland not far from the Persian Gulf, and some 40 miles from the Island of Bahrein where a subsidiary of the Standard Oil Company has developed an oil field of considerable size. Oil was found in the Arabian well at a depth of 2,152 ft. The geological structure is similar to that of the Bahrein field.



Jersey Standard's hydrogenation plant at Bayway, an important unit in the petroleum-chemical industry.

Chemical Trends In Petroleum Industry

Isopropyl Ether, Iso-Octane and Other Products of the Petroleum Chemical Industry Promise Important Increases in Engine Efficiency.

By M. B. Hopkins
Standard Alcohol Company

THE RECENT announcement by the Standard Oil Development Company[1] of the new high octane gasoline blending agent, *Isopropyl Ether*, following so closely the commercial introduction of iso-octane for improving aviation gasoline quality, is an indication of the rapid strides of applied chemistry in the petroleum industry. The development of these products and the widespread activity in development, manufacture and commercial utilization of chemicals of petroleum origin are of increasing interest and importance.

For years petroleum technologists have been working to make high anti-knock engine fuels so as to keep pace with automotive engineers' advances in engine design. At first it was just a matter of locating crudes from which gasoline with suitable characteristics could be obtained. Then came addition agents of which tetraethyl lead was, and continues to be, of outstanding utility. Coal tar aromatic hydrocarbons were found to be useful for blending in gasoline but the supply is very limited. Anhydrous alcohols were similarly tried out but their merit was to a large extent offset by inherent disadvantages. Next, the industry found that the cracking operation could be manipulated to give improved anti-knock fuel.

Now chemists are seeking to make new products out of petroleum raw materials which can be used as anti-knock fuels by themselves or can be blended with gasoline to make base stocks to which small quantities of tetraethyl lead can be added to make very high anti-knock motor fuel. Iso-octane was the first such material. It is synthesized from isobutylene (produced in cracking petroleum) by first polymerizing to di-isobutylene and then hydrogenating. Before its introduction commercially, its properties were well known through its use in the laboratory as a standard anti-knock reference fuel and through its experimental use to demonstrate the possibilities of high output aviation engines. In 1935 Klein[2] reported full scale engine tests, made with an iso-octane gasoline blend and conducted by the U. S. Air Corps in 1934, which showed that a fuel of 100 Army octane number gave an increase of 15–30 percent power output as compared with a fuel of 92 Army octane number. Iso-octane is now available in commercial quantities at a cost which makes its use in aviation fuels profitable. This has resulted in an increasing number of plants being constructed in large U. S. refineries to convert the isobutylene content of cracked gas to anti-knock motor fuel.

Isopropyl ether is the second such material of definite chemical composition to be offered for use as an anti-knock blending agent. It is made from propylene which, like isobutylene, is also a constituent of refinery cracked gases. Its physical properties are shown in Table I, in comparison with iso-octane.

The boiling point, vapor pressure and freezing temperature of isopropyl ether are all suitable for material to be blended in motor fuel. The heat of combustion and, therefore, the potential energy, is low when compared with hydrocarbons but it has been found that in using blends of gasoline and isopropyl ether lower air fuel ratios can be used without overheating the engine cylinder head with the result that there is no loss in miles per gallon of fuel. Unlike alcohol, isopropyl ether is not sufficiently soluble in water to cause its separation by the addition of water, nor will isopropyl ether take water into solution in gasoline to the same extent as alcohol. This is important because water dissolved in gasoline at high atmospheric temperatures will separate as ice and block the fuel line if cooled below its freezing point. All difficulty of this kind in the case of small traces of water taken into solution in gasoline by isopropyl ether may be completely avoided by using a fraction of one percent of methanol in the blend to prevent any ice formation.

Isopropyl ether blended in gasoline is slightly superior to commercial iso-octane in raising octane number. It is effective in the presence of lead, and the amount of

[1] Standard Oil Company (N. J.) press release June 5th, 1936.

[2] Journal of the Aeronautical Sciences, March, 1935.

A section of the huge Bayway refinery: the area marked off by the white line is the chemical products plant where many chemicals of petroleum origin are manufactured for Standard Oil Company (N. J.) subsidiaries. (Right) Knock rating tests on motor fuel with knock-inhibitor petroleum chemicals added.

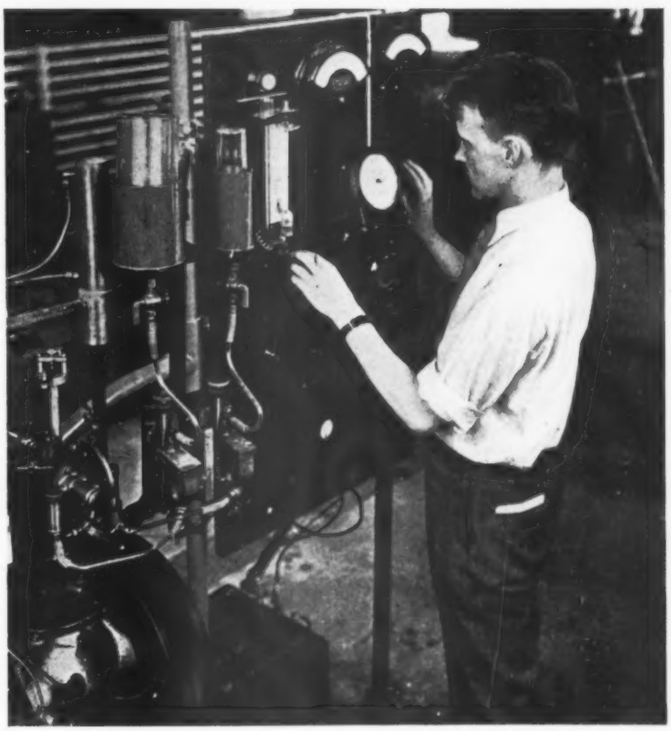
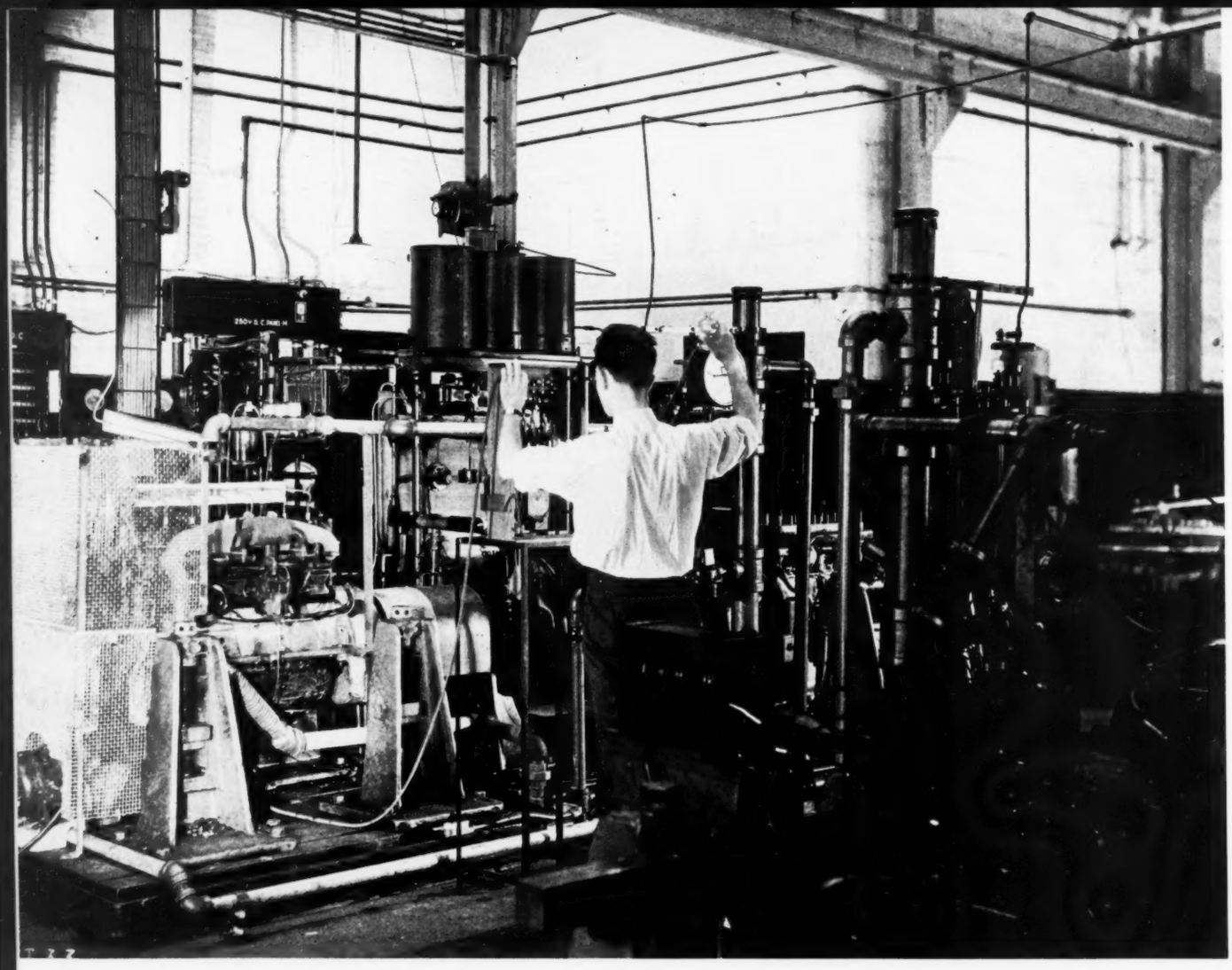


TABLE 1

Properties of Isopropyl Ether

	Isopropyl Ether	Iso-Octane	Benzene
Boiling Point	153.5°F.	211°	175°
Specific Gravity 20/4	.724	.691	.878
Index of Ref.	1.368	1.3916	1.501
Freezing Point	—125°F.	—162°F.	42°F.
Viscosity 25°C. Centipoise	0.322	0.543(65°F)	0.647
Heat of Vaporization	123	130	170
Heat of combustion gross — BTU/lb.	16900	20580	17650
Heat of combustion Net " "	15600	19200	17000
Heat of combustion plus heat of vaporization Net BTU/Gal.	95100	111400	125700
Vapor pressure Reid	5.3	2.2	3.2



Testing chemical products of petroleum origin at Jersey Standard's Bayway plant.

lead tetraethyl necessary to give a fuel of definite anti-knock quality is a little less with blends of gasoline and isopropyl ether than with blends of gasoline and commercial iso-octane. The blending of 25 percent isopropyl ether with a 74 CFR octane number gasoline will raise the octane number to 80.5, and the addition of 3 cc. of lead to the blend will result in 94 octane number. With 40 percent isopropyl ether in 74 octane number gasoline a U. S. Army octane number fuel of 100 can be obtained by the addition of 3 cc. of tetraethyl lead.

At the present time isopropyl ether is of particular interest to the aviation industry because large quantities can be made available from gas in every large oil refinery where cracking plants are operated. It permits operating engines with higher compression ratios, lower fuel consumption, and high power output such as is necessary at take-off. It will therefore be an important factor in aircraft development, and it is also believed that it will become of value to the automotive industry generally when, through large scale production, its cost can be lowered to make its use economical in ordinary gasoline.

In the use of petroleum hydrocarbons as raw material for new useful products, chemists were first successful in the solvent field. First, the natural hydrocarbons were themselves used as solvents. So-called varnish makers and painters naphtha and dry cleaners solvent are examples. The utility of these solvents being limited, chemists started work on synthesizing other chemicals from hydrocarbons so as to obtain products with many different special solvent properties needed by industry. There were four major developments in chemical synthesis of solvents from petroleum hydrocarbons. In one of these, paraffin hydrocarbons were converted to alcohols by first chlorinating and then converting the chlorine compounds to alcohols. In the second, chlorination is also the first step but the chlorinated products are converted to glycols. In the third, the unsaturated constituents of cracked petroleum gases are absorbed in sulphuric acid to form compounds which are hydrolyzed to split off alcohols. In the fourth, the chemical and physical properties of petroleum hydrocarbons are changed by high pressure reaction with hydrogen. The hydrogen used in this process is made by catalytic decomposition of petroleum gases. The hydrogen thus produced is used also to convert the oxides of carbon to methyl alcohol.

The manufacture of solvents has been followed by production from petroleum of such materials as resins, fungicides, detergents, chemical intermediates, drugs, fuel blending agents, rubber, radiator anti-freeze solutions, and a long list of products which were unknown a few years ago. Ethylene is being converted into

ethyl alcohol, ethyl ether, acetic acid, tetraethyl lead, acryloid resins, butyl alcohol, ethyl acetate, ethylene oxide, ethylene chlorhydrine, ethylene dichloride, vinyl resins, glycol, dichlorethyl ether, ethers and acetates of ethylene glycol, and more than fifty other products of less importance. Propylene is used to make isopropyl alcohol, isopropyl ether, acetone, diacetone alcohol, methyl isobutyl ketone, isopropyl acetate, propylene chlorhydrine, aceto acetate, oxybutyric acid, etc. The higher unsaturated hydrocarbons such as the butylenes, pentenes, hexylenes, etc., are used as raw materials to make the corresponding alcohols, acetates, ketones, and also in the manufacture of inhibitors, resins, etc.

The number of chemicals used in refining processes is also continually increasing. In recent years the increase has been due principally to efforts to refine by physical separations as contrasted with the wasteful chemical reaction of oil with sulphuric acid to remove impurities in the sludge. Important on the list of refinery reagents are phenol, acetone, benzol, dichlorethyl ether, croton aldehyde, sulphur dioxide, furfural nitrobenzene, and many different chlorinated hydrocarbons.

In the development of materials to improve the quality of lubricating oils also, the petroleum chemists use petroleum hydrocarbons as raw material. The Standard Oil Company of New Jersey found that when a synthetic oil which it had built up starting with refinery gas is blended with an ordinary well refined lubricating oil, the resulting product has temperature viscosity characteristics better than lubricating oils from Pennsylvania crude, which had previously been considered the standard of quality. The same company also synthesized from petroleum raw material a product which in many instances can be used to advantage to avoid the costly process of completely dewaxing motor oils. A small percentage of this product, when added to lubricating oil, inhibits the crystallization of the natural waxes occurring in the oil with the result that the oil flows freely at low temperatures.

The chemical industry furnishes oil refineries numerous types of oxidation inhibitors. Untreated cracked gasolines will react with oxygen of the air. Chemical inhibitors prevent this reaction which would otherwise result in gum to clog the fuel line or carburetor, lower the antiknock quality of the gasoline, cause sticky valves or other trouble against which motors must be protected. Lubricating oil inhibitors are in common use to make petroleum lubricants stand up under heavy duty conditions. The refining of a lubricating oil to improve one quality frequently results in lack of stability in another respect. Chemical inhibitors are used to obtain stability.

The trend in the manufacturing end of the petroleum business is already definitely colored by chemical processes. An increasing number of chemical products is being used by the petroleum industry. The petroleum industry is supplying the raw materials for chemicals needed in other industries. Synthetic chemicals from petroleum are rapidly increasing both in number and in volume. In the United States chemical work in the petroleum and related fields probably equals in quality, as well as volume, the chemical work in all other fields combined. Beyond the oil fields, the oil industry is becoming a chemical industry.

The size of these hydrogen compressors at Jersey Standard's Bayway plant indicates the enormous volume of hydrogen used.

New Refinery Grant Disturbs French Trade

Concession to Starnaptha Creates Apprehension as to Future Course of Government—Country Already Has Excess Refining Capacity—Strike Reveals Essential Service of Oil.

PARIS, JUNE 15

CONVINCING evidence of the extent to which the industrial activities, and indeed the very life, of a modern urban community is dependent upon petroleum, was provided by the series of strikes which have taken place here during the past ten days. Had the struggle continued longer actual suffering for the necessities of daily existence would have resulted. As it was, the suspension of traffic and interference with the distribution of food and other commodities caused serious inconvenience to members of all classes.

Refinery workers and employes in the principal wholesale and retail distributing stations stopped work on June 3 and remained out until the following week. Operators of motor vehicles had varying quantities of essence in their tanks but this supply was soon exhausted, and before the week was out three-fourths of all the taxis and the majority of private cars had been compelled to suspend operation. For once pedestrians came into their own in their use of the Paris streets.

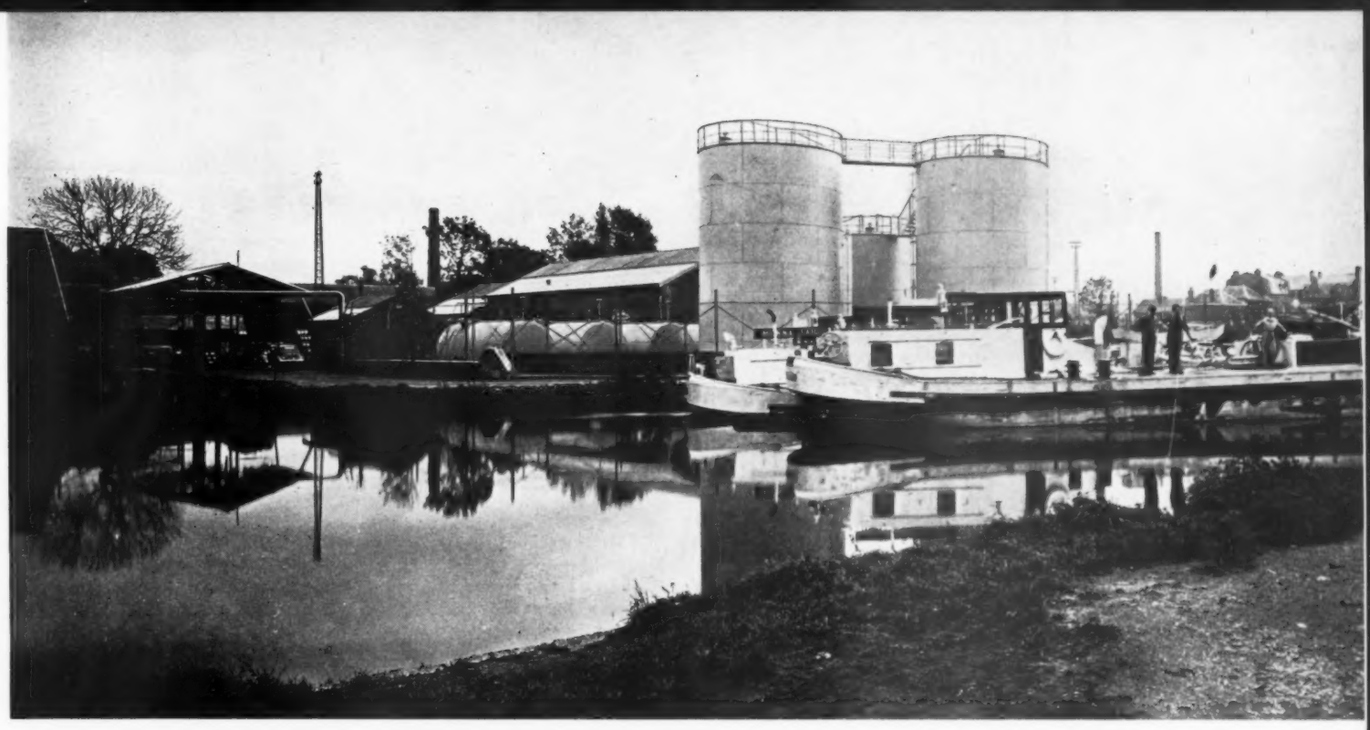
Deliveries were interrupted and many food shops, bakeries and other establishments were forced to close for lack of fuel oil. Hotels were unable to feed their guests and in the restaurants that remained open prices went sky high. Even airplane schedules were disarranged because of the lack of fuel. There was no disorder and no attempt on the part of the strikers to interfere with transporation. It was simply that business stopped because of the absence of that modern source of power that makes all sorts of wheels go round.

Bulk plant of an independent distributor in France.

Contemplation of the loss and inconvenience that resulted from a six-day suspension of the ordinary traffic in petroleum products raises the question of what would happen if, through some combination of events, oil supplies were to be shut off for a longer period. The ordinary consumer has no means of storing more than very small quantities of gasoline, fuel oil or lubricants, and even large commercial users are little better off in this respect. The only way of avoiding a shortage would seem to be the maintenance of reserves in public storage and recognition that oil is a necessity, the distribution of which must be maintained at all costs.

Interruption of ordinary routine by a general strike is a temporary, though annoying, incident. Other problems more difficult to dispose of remain to disturb the French petroleum trade. Aside from the disruption of business and loss of sales arising directly from the strike, there is the difficulty resulting from the heavy burden of taxation and the high cost of motor fuel which prevents a normal gain in the volume of consumption. There is the oversupply of products, refining capacity and distributors acting as a constant incentive to price cutting and market demoralization. There is, finally, the constant output of new official rulings and regulations placing fresh difficulties in the path of refiners and marketers. As a consequence of these conditions it has been practically impossible for integrated oil companies to operate at a profit during the past few years, while many of the large companies have incurred extremely heavy losses during this period.

An example of the sort of thing that discourages members of the French oil trade and creates a complete lack of confidence in the policy of the government toward the industry was the grant, on May 28, of an import and refining con-



Oil depot in Cambrai with land and water transport facilities.

cession to the Compagnie Petrolifere Starnaptha. The quantity of products involved in the concession is of no great consequence, being limited to 32,000 tons of petrol, 5,000 tons of kerosene and 15,000 tons of gas oil. The significance lies in the fact that this quantity is added to a market already oversupplied and that it is a violation of the more or less implicit understanding existing between the government and the oil companies for the past several years.

It will be remembered that the law of 1928 set up a definite policy looking to the development of refining facilities in France sufficient to supply the country's requirements of petroleum products. That law provided for a system of import licenses. One class of these licenses, covering the import of refined products, was limited to a duration of three years and was intended to cover the gap until domestic refining facilities could be provided. Another form of license, applying to crude oil only, was to run for twenty years and was designed to assure the necessary supply of crude to refineries then in existence or to be constructed. The system of general licenses covering imports of crude or products in quantities less than 300 tons per month was retained for the service of small dealers.

Acting upon the assurance conveyed in this legislation, an extensive program of refinery construction was carried out in France and milliards of francs were invested by a large number of companies in conformity with the purpose of the law. In anticipation of a steadily growing demand for motor fuel and other products, the refining capacity provided was somewhat in excess of the requirements of the nation at the time when the building campaign was completed in 1934.

This anticipated increase in demand has not materialized because of increased taxation and difficult economic conditions. In the six-year period from 1927 to 1933 the growth in the use of petroleum products was over 100 percent, or at the rate of roundly 300,000 metric tons yearly. In the past two years this has fallen to less than 70,000 tons and it is doubtful whether 1936 will show any increase whatever over last year. Consequently, it has not been possible to utilize the refining capacity already provided, while the continuation of a great number of import licenses still further complicates the situation.

Under these conditions it is not surprising that the petroleum trade receives with some dismay the announcement of the issuance of a new permit for refinery construction. The application of Starnaptha for such a concession has been pending for more than a year. It was opposed, naturally enough, by the existing refineries and apparently was not looked upon with particular favor by the officials of the petroleum administration. Its backers appear, however, to have had sufficient political influence to put their project across.

More or less mystery surrounds the affair, especially in view of the fact that another Roumanian company, the well-known Credit Minier, has had a similar application pending for a long time past without any success in obtaining a permit. S. A. Starnaptha was organized in Roumania, in 1926, with Prince G. Bibesco as president. It was, and is, a small company with six or seven wells producing about 400 bbl. daily. A French company, Compagnie Petrolifere Starnaptha, was formed to take over its financial direction and it is this company to which the refinery concession was granted. Subsequently S. A. Starnaptha was reported to have made arrangements with Dacia Romana to take over part of the latter's Roumanian production.

Since the new concessionaire is compelled by the terms of the permit to erect a refinery, a site for which is reported to have been selected near Marseilles, there is considerable speculation as to its operating program. The company is required to use Roumanian crude and, unless it has made arrangements for a sufficient supply from sources under its control, difficulty may be encountered in this direction. Moreover, the quantities of products which it is permitted to distribute in France are considered too small for the economic operation of a refinery. One report is that 50 percent of the output of the projected plant will be exported, but this program also presents some difficulties. These matters, of course, are the concern of the company itself.

Under other conditions and with a normally expanding market, the advent of a new refining interest of this size would create hardly more than a ripple of excitement. The concern of the petroleum trade is caused mainly by the possibility that the government may make further breaches in its original policy, and by the fact that, in a market as unsettled as that of France, the appearance on the scene of any new competitor is likely to add to the existing confusion.

Sir John Cargill Discusses "Pint Pots"

No Room for Additional Outside Supplies in India, He Says—In Case of Overflow Burmah Might Be Forced to Invade Other Markets.

ADDRESSING the annual general meeting of Burmah Oil Company Ltd. in Glasgow, June 5, the Chairman, Sir John Cargill, presented an incisive statement of world conditions in the petroleum industry. He said:

"The many dividend announcements by the industry have already made most of you aware that 1935 has witnessed generally a considerable improvement in world conditions affecting the market for petroleum products. If not yet complete, or too firmly based, there has been increasingly better control over extravagant production in the United States of America and generally other producing countries have regulated their production to the economic outlet available for it. Roumanian production, on the contrary, has not been so regulated. It has continued to be forced into export at values which must be absolutely unprofitable to many of its producers and has been a disturbing factor both directly and indirectly because, for purposes of acquiring foreign exchange, some countries which have imported it have offered and given inducements for re-export to others at prices even lower than these consuming countries could have laid them down from Roumania direct.

"Then again one country after another, abandoning economics and following a policy of opportunism, whether for reasons of national unemployment or of self-sufficiency or of national defense, have to a greater or lesser extent continued their efforts to reduce their dependence on imports of the natural petroleum which they do not possess by recourse to much more expensive indigenous synthetic substitutes, such as alcohol from crops or the products from the hydrogenation or low-temperature distillation of coal.

"Even so there has been, however, generally throughout the world an increased outlet for natural petroleum. While India has participated in such increased demand in respect to petrol and fuel oils, the demand there for kerosene declined as compared with 1934, making it quite clear that such improvement as there may have been in the world value of agricultural products has not yet filtered through to the cultivator in India, who represents such a preponderating part of that country's population and on whose prosperity the purchasing capacity of India so largely depends.

"To an extent perhaps less in volume than in 1934 yet spread more widely than in that year over our market in India, imports of the sort of 'distress' Roumanian production to which I have referred and, if for quite other reasons, also from Russia, called, as they may increasingly call, for continued vigorous action by us to defend the outlet essential to the maintenance of the volume of indigenous production. There is, of course an alternative which we certainly do not contemplate, that is to make room for such imports at the expense of the indigenous industry and of those important indigenous interests of local employment and revenues bound up with it."

After observing that the sort of competition referred to caused the company no particular anxiety the Chairman continued:

"There is, however, developing in our marketing part of the world, but outside India, a new source of production, in hands which hitherto have had no or very little marketing position there, which may or may not—I do not know and cannot say—have ambitions for its outlet which may not fit into the existing scheme of things. I do not imagine that those who control this new source have other economic views than that indigenous production has the first call on the consuming demand in its own country. India's requirements, however, are not being—and never have been—completely met by the indigenous production, and there may not be the same sort of recognition by this new production of any vested importing interest there.

"All I wish to emphasize today is that you cannot put more than a pint into a pint pot without an overflow. If, then, there is to be an overflow which involves us and threatens the maintenance of the volume of indigenous production, our own production may be forced into export, and I must point out that to that extent this will cause the pint pots of other markets in their turn to overflow."

This warning by the Burmah chairman was of a general character, and might have been applied to a large number of possible competitors but for the reference to the part of the world in which the new production is developing. With this reference in mind, British oil circles interpreted the above passage in the speech as referring directly to the operations of the Standard Oil Company of California, and the developments of that group in Bahrein Island and Saudi Arabia. The only other possible source of new competition from near India would be from Mosul Oil Fields Ltd., but several factors tend to diminish the importance of any threat to Indian distributors from this direction. In the first place, the whole direction of Mosul Oil's trade development and connections has been toward the Mediterranean and Europe, and secondly, the company must await the building of a pipeline or railway before it will be in a position to market oil.

Eastern developments of Standard of California are on a different plane, for twenty-six producing wells have been completed at Bahrein, and a large and growing output already has been obtained.

Whatever new source may have been in Sir John Cargill's mind, there can be no doubt that fresh entrants into the Indian market for petroleum products will meet with the keenest of opposition from existing interests established there. Burmah has itself engaged in many bouts of price cutting to retain its preponderant share of the market, having started as early as 1895 in a test of strength with the Royal Dutch-Shell group. Most of the previous major price wars have finally ended in cooperation between the participants, and the groups now occupying the greater part of the market, apart from Burmah, are Royal Dutch-Shell and Socony-Vacuum.

Burmah is very strongly entrenched in the market, operating through the Burmah-Shell Oil Storage and Distributing Company of India, a practically complete stock ownership of Assam Oil Company

and a working arrangement, involving Burmah financial backing, with the Attock Oil Company.

Kerosene, the main product in demand in India, is subject to a pool to which all the major importing and distributing groups contribute, with the regular division of the market and the stabilization of prices as its chief object. With the main market in India thus divided, and subject to cooperation between the groups concerned, a new major distributing interest would find difficulty in obtaining a footing. But its efforts probably would make a correspondingly serious disturbance to the established scheme of distribution, and might seriously disorganize the market.

One of the major arguments put forward by Burmah for its strong defense of the Indian market in the past has been the fact that its operations support local employment and revenue by disposing of indigenous production, Burmah being an Indian province. This line of reasoning may be weakened to some extent by the separation of Burmah from India under the Government of India Act.

This prospect may have some connection with Sir John Cargill's reference to the "pint pot overflowing", indicating the possibility of Burmah production having to find a new market if any considerable part of the Indian market is lost. Burmah has very easy access to facilities for ocean transport through its connection with the Anglo-Iranian and the Royal Dutch-Shell groups, and its entry into other world markets is therefore quite within the realm of practical politics.

Since Burmah's chairman delivered his speech, however, a somewhat different aspect has been placed on the position of Standard of California in the East through its alliance with The Texas Corporation in the California Texas Oil Co., Ltd. to include the productive resources of the former with the marketing facilities of the latter. While the California company might be looked upon as an interloper in case it attempted to sell its products in Eastern markets, no such charge would lie against Texas since it has long been well established as a marketer, not only in Asiatic countries but in Australasia and other Pacific islands as well. While the advent of the projected new company might result in some expansion of the activities of The Texas Company subsidiaries which it would take over, the policy of these companies, reflecting that of the main Texas organization, has been to work in harmony with other established marketers and not to disturb the stability of the markets in which they have operated.

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Irish Free State Grants Refining Concession

ANNOUNCEMENT of the organization of Irish National Refineries Ltd., by a Dublin syndicate has been followed by statements of Irish Free State officials which indicate that the company is to have a virtual monopoly of petroleum refining. The company has a capital of £2,000,000 and construction of its refining plant which is shortly to be undertaken will be the largest industrial project to be undertaken in Ireland in some time.

The conclusion of this arrangement is the outcome of negotiations that have been carried on for several months between Free State officials and Thomas J. C. Burgess, head of London & Thames Haven Oil Wharves Ltd. and chairman of the recently incorporated £2,500,000 Parent Petroleum Interests Ltd. It is stated, however, that London & Thames Haven Oil Wharves as a company will have no interest in the Irish Free State enterprise beyond the possibility that technical advice may be given to the new company by representatives of the London & Thames Haven organization.

It appears that the Irish concession is an outgrowth of Mr. Burgess's association with Parent Petroleum Interests, Ltd. in which William R. Davis, builder of the refinery of Europaische Tanklager und Transport, at Hamburg, Germany, is a leading factor. It is reported also that Lord Inverforth is interested in this company. Mr. Davis is a director of Crusader Petroleum Industries Ltd. which was organized in London last year. The formation of this company caused much speculation in British oil circles at the time as no announcement was made as to its contemplated activities.

When Parent Petroleum Interests Ltd. was registered on Apr. 6 this year there was an equal lack of information as to its purposes but it was the general opinion that it was designed as a holding company for enterprises in which Mr. Davis and Mr. Burgess might become interested. This seems to be borne out by the announcement just made regarding Irish National Refineries Ltd. While the exact terms of the agreement between the company and the Free State government have not been made public companies now engaged or which may in future engage in marketing activities in the Irish Free State apparently will be obliged to purchase their supplies of refined products from Irish National Refineries, Ltd.

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British Imports Continue Restricted

DURING the month of May British petroleum imports declined 10.8 percent as compared with the same period of 1935, due to smaller receipts of motor spirit and fuel from nearly all the exporting countries. Quantities of crude and other products, however, were fairly well maintained. Thus far during 1936, receipts of crude have been slightly above 1935, owing to the sharp rise in shipments from Venezuela and the Dutch West Indies. There has been a corresponding decline, though, in shipments of crude from Mexico.

British Oil Imports By Products

(Bbl.)

	May 1936	5 Months to May 31, 1936	5 Months to May 31, 1935
Kerosene	422,543	2,519,857	2,475,200
Motor spirit	2,835,600	15,019,256	15,230,545
Lubricating oil	283,172	1,486,400	1,189,400
Gas oil	210,954	1,443,697	1,335,026
Fuel oil	1,660,884	7,064,256	7,832,515
Other sorts	857	177,915	202,542
Total products	5,414,010	27,711,381	28,265,228
Crude	1,343,058	5,711,087	5,479,600
Total imports	6,757,068	33,422,468	33,744,828

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Kuweit Activity

THE Kuweit Oil Company has begun transporting materials to the Kuweit oilfields as a preliminary to embarking upon extended oil-boring. Goods are arriving at Basrah by sea and thence are transported by road. The Iraq Government has declared the Basrah-Zubeir-Kuweit road as a transit route for the Company's materials. The Kuweit Oil Company also proposes to install a private telephone line to Basrah for its own use.

Robinson-Patman Act's Effect on Marketing

Important Provision so Far as Concerns Oil Industry is Prohibition of Discriminatory Prices or Special Concessions, but Exact Application Remains to be Determined by Legal Interpretation.

ORIGINALLY intended as an additional curb on price discrimination in the sale of merchandise in chain stores, the Robinson-Patman Act as finally passed is so comprehensive in its scope as to affect industry generally. The bill amends Section 2 of the Clayton Act. Attorneys have been called on by the oil companies to advise them as to what bearing the measure has on the marketing of petroleum products and the following information is based upon a statement covering the bill by an attorney well versed in oil law. Formerly in the government employ this attorney is now in private practice. His understanding of code regulations under the NRA was highly regarded, and his opinions on this measure may be accepted as sound.

He points out that while the measure covers all commodities and all industries, it can best be understood by oil men by considering it in the light of the petroleum industry. So while oil is mentioned here, it should be noted that the act not only applies to oil companies but to equipment and supply houses selling to the oil companies, oil company customers and all other concerns as well, if they do business in more than one state.

The bill applies to various aspects of marketing, but the exact limits of its application are as yet uncertain.

In its general scope the bill is aimed to benefit small buyers as opposed to large buyers, and to benefit manufacturers as opposed to marketers. Looking at it from the viewpoint of the petroleum industry the elimination of discriminatory prices and special concessions may be regarded as broadly beneficial. The situation, however, is not simple. It will take years before the ramifications of this act can be tested through litigation and determined by final decisions handed down by the higher courts.

Effective enforcement of the act throughout American industry, in the opinion of this expert, would require a staff as large as that employed in enforcing provisions of the NRA. It is therefore, he says, probable that certain industries may be first to feel the effects of enforcement.

Prevention of price discrimination is the keynote of the act. It provides that a seller, who sells in more than one state, shall not discriminate in price between different buyers of merchandise of the same grade and quality, where the discrimination lessens competition with either the seller or the purchaser, or with customers of the seller or purchaser. This includes sellers of gasoline, or other petroleum products. Under terms of the act it appears immaterial whether a particular sale is made only in one state, if the seller sells in more than one state. A seller who grants a customer a lower price than that granted to another customer can justify it only by showing a saving of sales expense, cost of manufacture or delivery charges arising from different methods or quality. Or he may show that the change in price was made to meet an equally low price of a competitor. In the latter case he is only allowed to meet and not go below such a competitive price.

The question of "quantity discounts," which figured so extensively in hearings during consideration of the bill, is covered. The Federal Trade Commission is authorized to establish a scale of quantity discounts. But it is the expert's opinion that such a scale may not be established in the oil industry for some time. He points out that there are other industries where this question of quantity discount is more acute. Also that the oil companies will probably be slow in asking that such a scale be fixed because to petition for such action might hamper them in opposing a proposed scale which might be deemed harmful.

Under the Clayton Act as originally passed, burden of proof on a complaint of price discrimination was entirely on the individual or firm bringing the complaint. Under the act as amended all the complainant has to prove is that there was a difference in price. Once this is established the burden of proof as to whether the price difference is justified is up to the seller involved in the complaint.

Questions of rebates, refunds and allowances are dealt with in detail in the act as amended. Sellers are forbidden to give and buyers to accept, other than for services actually rendered, anything of value. This includes advertising allowances and other items named in detail. Unless such allowances are made to all customers they may not be made to one, or to an intermediary or subsidiary of that one. When applied to the oil industry this is deemed to include and forbid:

Loaning of gasoline pumps or marketing devices unless to all customers.

Painting of a customer's service station, unless similar service is granted all customers.

Under terms of the act those liable for violations include all sellers who sell in more than one state. Buyers, when they knowingly accept a discriminatory price, are made liable. Any one who is a party to or assists in a sale, knowing it to be at a discriminatory price is, under the amended act, as liable to prosecution as the actual seller, or knowing buyer.

The only exception made in the above is in favor of cooperative organizations. It is specified that cooperatives may return to their members the whole or any part of earnings or surplus gained. But cooperatives are not entitled to discriminatory prices from sellers on like quality and quantity over any other buyer.

There is no provision in the act as amended against any form of discrimination on export prices.

Attorneys for large oil companies are still examining the act. Some have prepared tentative opinions on its effect on petroleum merchandising, and are continuing to study it. This bit of caution is worth consideration by those in doubt as to their own policies: Any company selling to any customer at a rate not granted to another customer is putting both in danger of being parties in a test case, should another customer complain.

Pro and Con of the National Oil Problem

MEMBERSHIP in the sub-committee of the House Committee on Interstate and Foreign Commerce, which in 1934 was charged with the task of making an investigation of the petroleum industry of the United States, led perforce to a broad, if not necessarily deep, acquaintance with the chief problems of the industry. The committee travelled through the principal oil producing states, visiting important fields, and held protracted hearings at which representatives of all branches of the oil industry gave testimony. Technical and statistical experts submitted special reports and all this mass of evidence and opinion was embalmed in a series of volumes, comprising many hundreds of pages, constituting the record of the committee's labors.

A member of the committee, Hon. Samuel B. Pettengill of Indiana, has summarized the substance of the views and opinions presented before the committee in concise and readable form in a volume entitled HOT OIL—THE PROBLEM OF PETROLEUM.* While this title might lead the reader to look for something sensational, the book itself is a sound and serious study which states impartially the claims made for and against federal regulation of the oil industry and on other controverted questions. Direct quotations are numerous but are not carried to wearisome lengths and the summarizations of views and statements are often illuminated by trenchant observations on the part of the author.

Directing attention to the importance of the petroleum industry to the country Mr. Pettengill says:

"Tied up with it are the welfare of over a million workers, two million land holders, royalty owners and stock and bond holders; the social equities of 128,000,000 people, practically all of whom are consumers of petroleum products; the tax revenues of forty-eight states and the nation; the future of American industry, particularly aviation, merchant marine, and automobile and truck transportation; national defense in time of war, and the reverse English effect of petroleum on the soft coal industry."

In brief chapters and staccato sentences, Mr. Pettengill shows the difficulty of working out an acceptable national policy for petroleum. He shows that while the United States possesses perhaps 50 percent of the world's store of oil it is producing over 60 percent of the current supply, and that a continuation of this procedure will mean ultimately that America will have to depend on other countries to fill its domestic needs. He points out the inconsistency of those who advocate federal control of oil in the name of conservation and at the same time demand the exclusion of oil imports by means of high tariffs.

Hon. Samuel B. Pettengill

The concluding portion of the book is devoted to a discussion of state vs. federal control and the suggestion is advanced that an interstate compact affords the most effective means within the Constitution of dealing with the problems of production.

Representative Pettengill's work admirably fulfils its purpose of presenting a clear and condensed view of those controversial questions that must be faced in evolving a national oil policy. Since the issue is one that will recur again and again until it is properly settled, the book is one that will be read to advantage by all those who wish to inform themselves.

*HOT OIL, by Samuel B. Pettengill, M. C., 308 pages, 1936. Published by Economic Forum. ($2.50)

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Rise of American Oil

THE RISE OF AMERICAN OIL, by Leonard M. Fanning, 221 pages, 1936. Published by Harper & Bros. ($2.50).

Thoroughly familiar with the subject of petroleum and its relation to modern industry, which has been his study for many years, Leonard M. Fanning has produced a bright and readable book which is technically and historically accurate without being heavy. It traces the discovery of petroleum and its application to a multitude of industrial uses. It explains in language that the layman can understand the successive applications of geology, engineering and chemistry to the finding and utilization of oil, and shows in graphic fashion the many changes it has wrought in the everyday life of the present time.

Rarely, indeed, does one find a book like Mr. Fanning's, which can be read with equal profit and interest both by the man of technical training and the one who has but a rudimentary knowledge of the subject discussed. Its pages are crammed with facts so skilfully presented that they have more absorbing interest than most works of fiction.

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New Tanker Manual

TANKER TECHNIQUE, 1700–1936, by B. Orchard Lisle, 84 pages, 1936. Published by World Tankship Publications. (2/–).

This attractive manual has been carefully compiled and contains a great deal of new and original information concerning the history and development of the tanker from its inception to the current year.

While undoubtedly supplementing other valuable books on tankshipping, it is an excellent work of reference. It is well illustrated with pictures and the many diagrams are clear. The book contains statistics of no little interest—not the least of which is the table of the world's tanker construction, covering the entire period from 1700 to the present.

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New Unit for Petromex

PETROLEOS de Mexico, S. A. (Petromex) a company controlled by the Mexican government, has just signed a Dubbs license contract and will build a Dubbs 2-coil selective cracking unit in its refinery at Tampico.

The refinery now has a crude capacity of 3,000 bbl. a day and the Dubbs unit is to crack 1,100 bbl. a day. Petromex will build the unit under the supervision of Universal engineers.

The new construction program will include treating and re-running equipment. Considerable of the materials used will be purchased in Mexico.

The plant operates on crude from the Poza Rica and the Panuco fields. Besides producing gasoline, the Dubbs cracking unit will furnish fuel oil for the Mexican National Railways.

Foreign Oil Legion

H. M. Herron, President, The California Texas Oil Co., Ltd.

CARRYING out plans described in June WORLD PETROLEUM for a consolidation of their producing and marketing interests in the vast area east of Suez and west of California the Standard of California and The Texas Corporation, through their executive heads, on June 26 announced the formation of The California Texas Oil Company Ltd., to operate in that field.

Bachrach

H. M. Herron

James A. Moffett

The two parent companies will be equally represented in the ownership of the new company and on its board. James A. Moffett, Vice-President of Standard of California, former Vice-President of Standard Oil Company (New Jersey) and former Director of the Federal Housing Administration, will become Chairman, a position to which he is well fitted by his long experience and familiarity with international oil affairs. Other representatives of Standard of California on the board of the new corporation will be R. H. Morrison and Max Thornburg who will serve as Vice Presidents.

As President of the company H. M. Herron, General Manager of the Export Department of The Texas Company, has been selected. Mr. Herron is one of that numerous group of prominent oil men who hail from Olean, New York. He received his early education in the schools of that city and later took a course in business management and economics at the University of Rochester. He entered the service of The Texas Company in 1910 as a stenographer at the Port Arthur terminal and became Superintendent in 1916. Subsequently he served in various capacities in the refining and terminal divisions of the company before joining the export department in 1928.

During the greater part of the past eight years Mr. Herron has been Assistant Manager of the Export Department under Capt. T. Rieber and in that capacity has made several trips around the world, acquiring personal familiarity with the operations of the company in Europe and the East. When Captain Rieber became Chairman of The Texas Corporation in 1935 Mr. Herron was made General Manager of the Export Department.

Other representatives of The Texas Corporation on the board of California Texas Oil Company will be J. V. Murray who will serve as Director and William Kunstadter who will be Secretary and Treasurer.

ING. DANIEL REY VERCESI, who is associated with the Institute of Geology and Drilling of Uruguay and with the "Ancap" refinery in Montevideo, and Dr. Reynaldo Deambrosia, expert in chemistry, are making a study tour of the United States which will extend over several months.

OWING to the increase in the activities connected with the secretarial work of the Oil Industries Club, London, Mr. F. H. Coe of the Baku Consolidated Oilfields, Ltd. has been appointed Secretary to relieve Mr. R. B. Rogers. The latter has consented to continue as Honorary Secretary until the end of the year.

HERBERT GREEN, chairman and managing director of Herbert Green and Company Ltd., was a passenger to New York on the maiden voyage of the QUEEN MARY

FRED R. ALLNUTT has withdrawn as managing director of the Clarendon Petroleum Company, Ltd., English subsidiary of the Tide Water Oil Company, to become managing director of the European operations for the Alliance Oil Corporation. The activities of Mr. Allnutt in the United Kingdom and on the Continent are well known to the European oil industry.

JOHN R. SCHMITT associated with the Tide Water Oil Company for over sixteen years, as one of its key men, being active in the wholesale, export and industrial division has been appointed treasurer of the Alliance Oil corporation. He spent several years living in South America and Europe where he played an important part in the organization and development of marketing units for the Tide Water. His new field of operations should prove of great interest to many of his old friends in the petroleum business. It will be remembered that L. C. Quakenbush heads the Alliance.

World Oil Production — Official Figures for 1935 and 1936 Revised

All figures furnished direct to WORLD PETROLEUM by Governments, except where otherwise specified

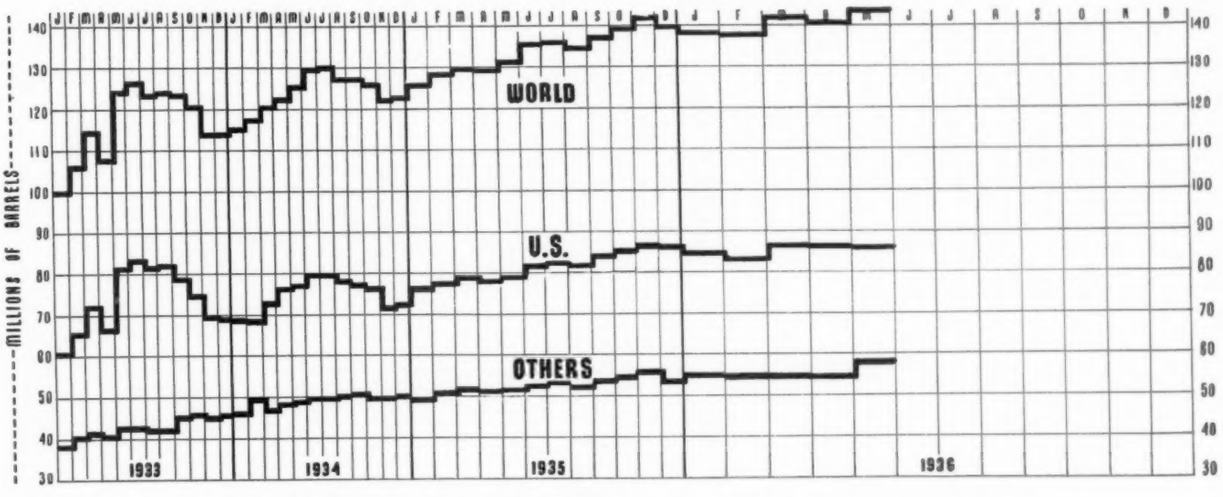
(Figures in U. S. Barrels—Conversion ratio 7 bbl.=1 ton)

Country	June 1935	July 1935	August 1935	September 1935	October 1935	November 1935	December 1935	January 1936	February 1936	March 1936	April 1936	Provisional Figures May 1936
United States	82,338,000	85,485,000	84,816,000	84,109,000	88,160,000	86,475,000	88,711,000	88,820,000	82,120,000	90,568,000	90,479,000	89,297,350
Russia	14,232,400	14,777,000	15,091,300	14,849,100	16,040,500	16,050,000	16,100,000	16,353,400	15,278,200	16,340,800	15,100,000[1]	15,550,000
Venezuela	13,075,118	13,429,885	12,628,067	13,151,362	13,681,619	13,152,776	13,389,789	13,487,089	12,849,480	13,432,671	13,442,870	17,222,933
Roumania	4,842,000	5,075,000	5,030,000	4,932,000	5,181,000	5,215,000	5,361,000	5,242,000	4,809,000	5,209,000	5,226,000	5,568,000
Iran[2]	4,200,000	4,249,000	4,634,000	4,270,000	4,109,000	4,522,000	4,816,000	4,627,000	4,480,000	4,641,000	4,312,000	4,683,387
Netherland India	3,463,061	3,531,857	3,699,430	3,661,259	3,767,596	3,528,889	3,612,056	3,614,436	3,407,194	3,670,877	3,532,375	3,721,613
Mexico	3,453,871	3,573,632	3,570,908	3,442,259	3,461,457	3,340,713	3,666,265	3,377,302	3,285,965	3,542,088	2,997,883	3,230,336
Iraq	1,993,586	2,445,625	2,166,794	1,962,541	2,374,393	2,309,867	2,240,819	2,327,332	2,107,210	2,515,345	2,048,053	2,467,136
Colombia[4]	1,518,460	1,639,054	1,576,307	1,555,676	1,623,372	1,582,952	1,004,474	1,611,618	1,475,403	1,619,620	1,427,193	1,598,544
Peru[5]	1,414,588	1,448,225	1,442,565	1,448,133	1,493,236	1,343,848	1,381,031	1,377,006	1,293,627	1,351,810	1,403,626	1,500,485
Argentina	1,161,638	1,198,550	1,198,537	1,152,919	1,200,698	1,193,434	1,304,554	1,310,129	1,273,243	1,366,691	1,156,440[1]	1,264,273
Trinidad	972,904	988,341	1,003,382	992,445	1,015,492	1,078,957	1,086,530	1,079,082	983,424	1,081,191	1,026,423	1,066,728
British India	768,692	791,774	796,150	775,133	790,612	649,041	841,764	854,644	756,384	791,162	735,660[1]	784,300
Poland	294,000	308,000	315,000	301,000	308,000	294,000	308,000	338,800	323,400	338,800	323,400	331,100
Brunei	269,290	283,430	281,400	256,480	233,310	242,900	274,540	253,400	237,930	257,250	270,900	225,890
Germany	257,369[3]	276,990[3]	241,801[3]	229,712[3]	232,659	236,789	263,879	254,492	227,444	274,393	246,519	244,552
Japan	144,160	146,863	152,290	144,312	158,165	145,749	147,827	183,651	165,877	196,569	194,167	195,595
Sarawak	150,850	151,830	154,000	145,600	148,400	141,400	140,700	139,300	127,050	136,290	130,900	134,610
Ecuador	137,806	144,812	135,549	138,986	147,449	143,518	146,541	148,980	138,721	162,125	159,666	163,855
Canada	120,102	118,812	117,652	123,919	122,525	116,756	125,658	121,231	107,928	117,824	117,570[1]	107,748
Egypt	99,270	103,488	104,937	100,954	103,341	96,495	94,969	91,497	97,573	111,846	101,038	107,989
France	46,000	45,276	46,312	43,530[1]	44,981[1]	43,530[1]	44,981[1]	44,981[1]	42,079[1]	44,981[1]	43,530[1]	44,981
Bahrein[1]	105,400	105,400	105,400	105,400	105,400	105,400	105,400	300,000	300,000	300,000	300,000	300,000
Others[1]	75,000	75,000	75,000	75,000	75,000	75,000	75,000	75,000	75,000	75,000	75,000	75,000
Total	135,133,555	140,392,844	139,373,781	137,966,720	144,578,205	142,084,014	145,242,777	146,032,370	135,962,132	148,145,333	144,850,213	149,886,405

[1] Estimate. [2] Anglo-Iranian Oil Co. figures revised; fuel oil returned to the ground has been deducted. [3] Thuringia estimated 7,000 bbl.; official figure for Prussia. [4] International Petroleum Company's figures. [5] International Petroleum Company and Lobitos Oilfields Ltd. figures.
Russian Sakhalin included with Russia. Japanese Sakhalin included with Japan.

Official Crude Oil Production Figures for 1932 to 1936

	Total 1936	Daily Average 1936	Total 1935	Daily Average 1935	Total 1934	Daily Average 1934	Total 1933	Daily Average 1933	Total 1932	Daily Average 1932
United States	441,284,350	2,903,186	993,942,000	2,723,129	909,107,000	2,490,704	898,874,000	2,462,670	785,159,000	2,145,243
Russia	78,622,400	517,253	176,688,100	469,608	168,648,700	462,051	149,901,900	407,950	149,719,000	409,070
Venezuela	70,435,043	463,388	152,363,382	417,434	142,072,329	389,239	120,882,802	331,186	119,596,512	326,766
Roumania	26,054,000	171,408	61,150,000	167,534	62,006,000	169,879	50,971,200	139,647	50,491,285	137,954
Iran	22,743,387	149,628	52,413,879	143,600	52,663,782	144,284	49,581,280	135,840	45,122,455	123,285
Netherland India	17,946,495	118,069	42,569,625	116,629	42,289,408	115,861	38,512,663	105,516	39,584,027	108,153
Mexico	16,433,574	108,116	40,234,902	110,233	38,167,022	104,567	33,904,882	92,890	32,802,285	89,624
Iraq	11,465,076	75,428	24,850,924	68,085	7,935,657	21,742	1,200,000	3,288	1,200,000	3,300
Colombia	7,732,378	50,871	17,617,654	49,740	17,340,724	47,509	13,157,127	36,047	16,384,956	44,768
Peru	6,926,554	45,569	16,835,206	46,270	15,936,937	43,663	13,923,281	38,146	9,899,266	26,026
Argentina	6,370,776	41,913	14,317,500	39,226	14,045,652	39,015	13,759,565	38,232	13,166,900	35,975
Trinidad	5,236,848	34,453	11,669,792	31,686	10,894,363	29,847	9,560,039	26,192	10,023,780	27,387
British India	3,922,150	25,804	9,227,496	25,281	8,997,399	24,650	8,721,655	23,893	8,600,312	23,500
Poland	1,655,500	10,891	3,973,200	10,885	3,697,617	10,130	3,858,085	10,570	3,905,230	10,670
Brunei	1,245,370	8,193	3,162,614	8,647	2,673,041	7,323				
Germany	1,247,400	8,207	3,054,023	8,409	2,266,964	6,211	1,712,823	4,692	1,824,019	4,983
Japan	935,859	6,157	1,848,656	5,065	1,484,962	4,068	1,377,761	3,827	1,575,333	4,375
Sarawak	668,150	4,396	1,811,297	5,002	1,948,044	5,337	2,289,472	6,273	2,274,043	6,213
Ecuador	773,347	5,088	1,725,354	4,727	1,655,062	4,534	1,622,624	4,446	1,573,857	4,300
Canada	572,301	3,765	1,434,467	3,930	1,418,810	3,887	1,147,825	3,144	1,054,373	2,880
Egypt	509,943	3,355	1,215,606	3,356	1,479,037	4,052	1,591,495	4,360	1,742,370	4,760
France	220,552	1,451	529,664	1,451	552,000	1,512	552,000	1,515	552,000	1,508
Bahrein	1,500,000	9,868	1,264,809	3,465	285,071	781				
Others	375,000	2,467	900,000	2,470	861,000	2,359	432,000	1,184	432,000	1,180
	725,876,453	4,768,924	1,634,800,159	4,465,862	1,508,426,581	4,133,205	1,417,534,479	3,884,022	1,296,682,923	3,544,940



World crude oil production by months, 1933–1936. Chart is weighted to compensate for variation in number of days per month. Ratio of U. S. crude production to world production.

World Petroleum Abstracts

Summaries of the Most Important Articles as Published in the Oil Press of the World Dealing With Technical and Economic Aspects of the Industry. *Edited by Dr. O. W. Willcox*

Petroleum Geology

SYNOPSIS OF THE GEOLOGY OF MEXICO.—Manuel Santillan, in BULL. AM. ASSOC. PETROLEUM GEOLOGISTS, vol. 20 (1936), No. 4, pp. 394–402.

Mexico is divided into five physiographic provinces, and a generalized description is given of the lithologic character of each of these provinces. A synopsis is given of formations representing the Proterozoic, Mesozoic, and Cenozoic eras and their component periods. Brief mention is made of some type fossils found and of the economic importance of certain parts of the section.

DEGREE OF REDUCTION OF SEDIMENTS IN THE EAST TEXAS BASIN AS AN INDEX OF SOURCE BEDS.—Parker D. Trask and W. Ross Keyte, before American Petroleum Institute, Tulsa meeting, 1936.

The data from the East Texas basin presented in this paper, in general, seem to support the concept that a low nitrogen-reduction ratio is a favorable indication of source beds, and a high ratio an unfavorable indication. Summarizing the relationships by formations, we find that it is unfavorable in the Wilcox; favorable in the Midway, Navarro, Taylor, Austin, and Eagle Ford; neutral, or perhaps slightly favorable, in the Woodbine and Washita; and neutral in the Fredericksburg and Trinity. The relationship, in general, is most favorable in those formations for which the most data are available. It accordingly seems probable that a definite relationship between low nitrogen-reduction ratios and sediments associated with oil zones prevails in the East Texas basin. The relationship, therefore, has thus far been found to prevail in three oil regions: the Rocky Mountains, the Mid Continent, and the East Texas basin. It is still possible, however, that this relationship may be apparent and not real; but each successive area in which it is found to hold strengthens the probability that it is real.

The relationship at present is being studied in three other petroliferous provinces; and, if it is found to prevail in each of them, the probabilities will be very great that it is a real relationship and, therefore, can be recommended to geologists as a practical tool in their search for petroleum. It should be borne in mind, however, that in each of the three regions which have already been examined, the relationship has not been found to hold universally. Consequently, the nitrogen-reduction ratio probably can never be expected to be an absolute index of source beds. Nevertheless, the chances now seem good that it may turn out to be a useful means of segregating sediments that are more likely to be source beds from those that are less likely to be source beds; and, if so, it should prove of economic value to the petroleum industry.

The nitrogen-reduction ratio here considered is the ratio of the nitrogen content to the reducing power of the formation, the reducing power being expressed as cc. of 0.4/normal chromic acid reduced by 100 milligrams of sediment.

PROGRESS IN AERIAL PHOTOGRAPHY.—A. F. Maple, in WORLD PETROLEUM, vol. 7 (1936), No. 4, pp. 180–184.

Under the caption "Discovering Oil from 20,000 Ft.," the author summarizes recent progress of aerial photography of especial interest to the geologist. Among the most important is the development of the "solar-navigator" which makes it possible to fly a network of triangulation accurate within about a quarter of a degree. This navigation device, recently perfected, also makes it possible to fly an accurate course at constant altitude independent of wind variations, so that aerial photographs will cover the area surveyed with the correct amount of overlap. The contouring machine for use with aerial photographs has been improved to a surprising degree, and it is now practicable to have a topographic map made from the aerial survey mosaic without sending a plane-table party into the field.

PALEOGRAPHY OF PARTS OF MEXICO ADJACENT TO WEST TEXAS.—Lewis B. Kellum, in BULL. AM. ASSOC. PETROLEUM GEOLOGISTS, vol. 20 (1936), No. 4, pp. 417–432.

A present trend in petroleum exploration is the search for buried shore lines. During Jurassic and Neocomian time the southern margin of the North American continent extended across northern Mexico and formed a peninsula extending southward across Coahuila. The basement rocks of this peninsula are today exposed in the deep canyons and along the pediments of some of the mountain ranges of Coahuila. The Mexican geosyncline lay adjacent to this peninsula on the east, west, and south. Much of the clastic sediment which accumulated in the geosyncline in Coahuila, and in eastern Chihuahua and Durango, was derived from this land mass.

In Aptian time the peninsula was peneplaned and the sea transgressed across it. Lagoons formed on the slowly subsiding land and gypsum deposits of great thickness and lateral extent accumulated in them. A gypsiferous facies in the Aptian-Albian series of Coahuila is closely limited to the area previously occupied by the peninsula.

The distribution of Upper Jurassic and Lower Cretaceous marine sediments, as well as certain similarities in the fossil faunas of these sediments in the Mexican geosyncline and in the Pacific geosyncline, strongly suggest a connection between the Atlantic and Pacific across northern Mexico during certain stages of the Mesozoic.

The Coahuila peninsula controlled the type of structures which developed during the Tertiary in the overlying sediments. There is a marked contrast between the relatively simple, open folding of Lower Cretaceous rocks above the peninsula, and the tight, asymmetrical folding and overthrusting in the area of the geosyncline on the east, west, and south. This relationship is similar to that observed elsewhere associated with foreland blocks.

STRUCTURAL GEOLOGY OF N. E. MEXICO ADJACENT TO ZAPATA AND STARR COUNTIES, TEXAS.—Wm. G. Kane, in BULL. AM. ASSOC. PETROLEUM GEOLOGISTS, vol. 20 (1936), No. 4, pp. 403–416.

The major structural features of the Eocene beds are shown in a way that enables the reader to get a fair idea of their relative size and significance. The several important anticlines, synclines, and fault zones are described, and a suggestion is made of a possibility of cross-folding influences from central Coahuila being projected eastward into the Gulf Coastal Plain of northern Mexico and South Texas.

Geophysics

ECONOMIC UTILITY OF THERMOMETRIC MEASUREMENTS IN DRILL HOLES IN CONNECTION WITH DRILLING AND CEMENTING PROBLEMS.—Eugene G. Leonardon, in GEOPHYSICS, vol. 1 (1936), No. 1, pp. 115–126.

During the past few years there has been a great development of geophysical methods for the purpose of gaining a more accurate knowledge of the conditions existing in drill holes. Quite lately a new method has attracted attention, namely, temperature measurements. This paper discusses this new approach to drill hole investigation and outlines some of the results that have been obtained.

The new method is based on the well known fact that thermic conductivity varies with the nature of rocks. Thus, in the language of thermometry a dry sand will have a conductivity of 3.10^{-4}, and the conductity of oil is about the same. It is 14.10^{-4} for water, 52.10^{-4} for some limestones and 66.10^{-4} or more for rock salt. This illustrates the wide range of the temperature parameter. The variations of the geothermic gradient will therefore be closely related to the succession of rocks encountered. This opens a considerable range of possibilities for obtaining information about a drilled well. By taking a series of temperature measurements at different levels of the hole, the heat conductivities of the different strata become known and inferences may be drawn regarding their natures, and also regarding other circumstances. For instance,

the height to which cement fluid has risen in a cementing job can be determined; gas-bearing and water-bearing formations can be located. However, although much has been gained it still remains to operate the method extensively under various practical conditions before gaining an operating technique and a sound basis for the interpretation of anomalies.

Black Magic in Geophysical Prospecting.—L. W. Blau, in GEOPHYSICS, vol. 1 (1936), No. 1, pp. 1–8.

In this paper attention is called to the prevalence of impostors who seek to impress uninformed persons with alleged methods of geophysical prospecting that are neither based upon scientific fact nor upon known or proven properties of oil, minerals, or geological formations. The geophysicist is often consulted concerning the reliability of such a proposed method and his task is then to explain scientifically just why the proposed method fails and is unsuitable for the intended purpose. Because such an explanation may often require a time-consuming investigation the geophysicist may be forced to spend more time thereon than is justified. Hence it is desirable to establish a register of as many as possible of these "new" methods in order to prevent duplication of these investigations. In the present paper Dr. Blau makes a start on such a compilation, and geophysicists are urged to send in a description of any new "doodle-bug" method that is brought to their attention, together with the details of their investigations thereon.

Efficiency of the Thyssen Gravimeter in Measurements on Salt Domes and Anticlines.—A. Schleusener, in OEL UND KOHLE, vol. 12 (1936), No. 18, pp. 381–384.

The mean error of the Thyssen gravimeter, as demonstrated by measurements on the Benthe salt dome, near Hannover, is less than plus or minus 0.2 milligal.; 26 measurements can be made in an 8-hour day.

Summary of Pending Patent Litigation Relating to Seismic Exploration.—C. R. Hrdlicka, in GEOPHYSICS, vol. 1 (1936), No. 1, pp. 137–140.

Particulars are given regarding suits filed by The Texas Company against the Sun Oil Company for alleged infringement of the Ludger Mintrop patent No. 1,599,538 for "geological testing methods," and the Burton McCollum patents No. 1,724,495 (method and apparatus for determining the slope of subsurface rock boundaries), and No. 1,724,720 (methods and apparatus for studying subsurface contours). These patents are being contested on the ground of invalidity.

On Seismic Computations, with Applications, I.—M. M. Slotnick, in GEOPHYSICS, vol. 1 (1936), No. 1, pp. 9–22.

The problem of depth determinations from data obtained by the method commonly called "reflection shooting" is an interesting and often important one. In this paper the author indicates a method for depth determinations in two cases that closely approximate some conditions that may be met with in practice. The discussion leads to a set of five charts that are universal in the sense that the charts are based on dimensionless quantities and are therefore applicable to any set of units and for any "spreads" desired. Inasmuch as the "average vertical velocity" is often used in practice, the results of the methods considered in the paper are compared with the results of the "average velocity method," and it is found that for short "spreads" the depths obtained by either method check very well.

Drilling

New Aids for Drilling Heaving Shale,—K. C. Sclater, in PETROL. ENG., vol. 7 (1936). No. 7, pp. 31–32.

In a wildcat well in Wharton County in southern Texas, the Pure Oil Company is using a sodium silicate drilling mud weighing 14.4 lb. per gallon, consisting of approximately two parts of sodium silicate to one part of saturated brine, 10 percent by weight of bentonit and 1½ lb. of Baroid per gallon of mud. According to previous experience by the Continental Oil Company in the same region, the sodium silicate reacts to form a coating that protects the shale from hydration, which is the primary cause of the heaving. However, in the present case it has been deemed necessary to devise methods to avoid disturbing the protective coating during drilling operations. To avoid a swabbing action, pulling of the drill pipe should be eliminated, circulation should be maintained continuously, and the drilling bit should be kept on bottom and rotation maintained continuously except when changing bits and adding drill stem. At the same time it is desirable, especially in deep wildcat wells, to take cores and run Schlumberger instruments for making a survey of the strata penetrated. To meet these various requirements, drill pipe is being used instead of casing with a three-way bit so that cores can be taken by a wire-line coring bit without having to pull the drill pipe. Open hole will be carried through the shale so that a Schlumberger survey can be run after removal of the drill pipe. Circulation is maintained continuously by means of full-hole continuous circulation joints in the drill stem.

Rotary-Drilling Practices.—J. E. Brantly, before Am. Petrol. Inst., Tulsa, 1936.

This paper is a brief discussion of salient points that are of most importance in drilling by the rotary system.

The fluid delivered to the bit is of primary importance in both volume and character.

Assuming the proper cutting tool is being used, probably the next most important factor in the drilling operation is the weight supported by the bit. Weight to be carried is controlled by the size of the cutting tool, the size and strength of the drilling shaft, the weight of the drill collar, rotating speed, fluid volume, and the nature and attitude of the formations being penetrated. In many formations the greater the weight, the more rapidly the hole can be made—all other factors being adequate, and within the limitations of the other requirements. This is not true, however, in all strata; the much discussed Brown shale of Kettleman Hills being a case in point.

Another extremely important factor is rotating speed; while its subsidiary, torque, is likewise important as affecting the work capacity of the drilling shaft.

The proper type and dressing of the bit is, of course, necessary to efficient drilling.

Each of the four factors is definitely controlled or influenced by the others; and, in order to obtain maximum economy and efficiency in any drilling operation, it is absolutely essential that all of them be applied in their proper balanced values. These values must be learned.

Expressed differently: for maximum drilling efficiency there is required an adequate volume of mud-laden fluid of the proper physical and chemical consistencies, the proper weight on the bit constantly and uniformly maintained, a regular and smooth feed or rate of descent of the bit into a given formation, a smooth and delicate rotating power—the most suitable bits for the materials being cut—and above all, intelligence in the selection and perseverance in the application and maintenance of these various factors in their correct values. It is doubtful whether anyone can say definitely what these values are or should be in any but very simple problems. The author urges the extreme importance of taking such steps as may be necessary to ascertain the proper values of these all-important factors of the process of boring a hole into the crust of the earth in the search for oil or gas.

Improved Drilling Speed and Its Influence on Cost.—E. C. Scott, in JOUR. INST. PETROLEUM TECHNOLOGISTS, vol. 22 (1936), No. 151, pp. 285–304.

Recent improvements in machinery and methods have resulted in big increases in drilling speed in the United States, especially on the Gulf coast.

These improvements have been brought about mainly by increasing the quantity of mud-flush circulated, through the use of big pumps operated by high-pressure boilers. The desire for increased fluid efficiency has also led to the use of drill pipe of larger diameter than previously, which in turn has dictated the use of very heavy hoisting equipment.

The application of these principles in a modified form in Trinidad is suggested, and it is maintained that the resultant increase in speed will yield a saving in drilling costs. In this island conditions differ somewhat from conditions in the United States, but even here about 30 percent of the cost of a well is directly proportional to the time taken to drill it; if the rate of drilling could be doubled it would be worth spending up to 75 cents a foot to do so. Recent experiments in Trinidad have proven that this is practicable, and it appears to be clear that new and up-to-date equipment will soon pay for itself in the way of accuracy, dependability and quick results.

Fibrous Materials for Restoring Lost Circulation in Drilling Wells.—Arthur Langton, in OIL AND GAS JOUR., vol. 34 (1936), No. 49, pp. 31–34.

This paper reports an investigation of a special form of filter press for use in testing the suitability of various materials for sealing off "thirsty" formations and thus preventing loss of drilling mud. The apparatus is designed to work with porosities such as are represented by gravel of one-inch size down to fine sand. As a standard testing mud use was made of Mojave clay which is widely used

in California oil fields. To this mud various materials were added and measurements were made of the thickness of a filtered layer that would stop escape of the mud. As a result of these tests it was found that a material known as Fibrotex, consisting of a special fibrous substance, gave most satisfactory results. The tests show that a combination of these fibers mixed in a mud containing the proper percentage of colloidal matter would restore lost circulation in any formation where the pore spaces or fissures do not exceed those of one-inch gravel. For crevices or fissures where the cross-sectional area is greater than this it is advisable to use a mixture of the fibers and gel-cement.

NICKEL-ALLOY STEELS IN DRILLING EQUIPMENT.—Albert G. Zima, before Am. Petrol. Inst., Tulsa, 1936.

Concise descriptions, with tables of physical properties, are given of the alloy steels used in the manufacture of drilling equipment such as bits, drill collars, kellys, tool joints, chain, drawworks, blocks, swivels, pumps, and other items such as control fittings and sucker rods.

Oil Well Operation

THE ECONOMIC LIFE OF SUCKER RODS.—Emory Kemler, before American Petroleum Institute, Tulsa meeting, 1936.

The evaluation of sucker-rod service and the determination of the economic life of any particular string of rods require a knowledge of the behavior of the rods under operating conditions. To be able to determine the time when rods should be replaced, it is necessary to know what would happen if the rods were to remain in service; i.e., it is necessary to have some analytical relation between the number of failures and the days of service. This paper gives a general law which has been found to give the relation between the number of failures and the days of service. This law has been used to derive a formula which gives the economic life of the rods. With the collection of more detailed information, it should be possible to determine the effects of speed, stroke, corrosion, loads, etc., on rod failures. A preliminary study of field records of test strings of sucker rods indicated that the number of failures could be expressed in the form of:

$$N = b\,T^m,$$

where N represents the number of the failure and T represents the time at which the *nth* failure occurred, b and m being constants which determine the character of the curve showing the relation between the number of the failure and the time at which it occurred.

Since a curve which can be expressed in the form as given above becomes a straight line when plotted on log-log paper, a large number of the records on test strings was analyzed by plotting the number of the failure against the time in days which the rod string had been in service. The slope of the straight line on log-log paper becomes the exponent of T, and the coefficient b becomes equal to:

$$\frac{1}{T_0^m}$$

where T_0 is the time at which the first failure occurs, provided the initial failures follow the general law. T_0 can be found by extrapolating the curve found to hold during the latter part of the life of the rods until this curve hits the time line at $N=1$.

In many cases the initial failures may occur earlier than the curve, which is based on the behavior during the latter part of the life of the string, would indicate. This is no doubt due, in many cases, to the fact that a few rods in the string have defects due to poor material or improper manufacture; and, after these few initial defects have been eliminated from the string by failures, the rod string then follows a consistent law.

COMBINATION GAS-LIFT AND CENTRIFUGAL PUMP.—H. W. Baker, in OIL WEEKLY, vol. 81 (1936), No. 6, pp. 36–38.

In the Oklahoma City field, where wells are around 6,500 ft. deep with 7-inch casings, successful use is being made of a combination gas-lift and bottom-hole centrifugal pump. In a typical installation the pump (97½ h.p.) is installed as near the bottom as possible, with a packer surmounted by a perforated adapter placed about 500 ft. above the pump. In operation the oil coming from the sand enters the pump intake and is propelled by the pump up through the inner 2-inch tubing and out through the perforations in the top adapter. It is confined in the annular space by the packer and is then gas-lifted to the surface. The gas-lift is accomplished by a steady injection of gas through perforations in the tubing.

The main advantage is an increased output above what could be obtained by either straight gas-lift or straight pump-lift, and the lifting cost is less. The output of residual oil is greater than by the single methods; more ideal pressure conditions are secured at the sand face, and reservoir gas is conserved.

In the Oklahoma City field the method has found application on a number of wells in establishing potentials and in making the prorated allowable after the potential had been established. This method establishes a larger potential than can be obtained by either the straight gas lift or the electrical lift at the present time. It is considered a fair and just method of obtaining potentials because of the more ideal pressure condition maintained at the sand face and the absence of swabbing effect. Cost figures are given.

WELDED JOINTS FOR OIL-WELL CASING.—Morvin Cook, before Am. Petrol. Inst., Tulsa, 1936.

Heretofore, safe depth for setting casing of large diameter was limited by the collapse rather than the joint strength of the tube. The development of deeper drilling establishes a trend toward the use of casing of smaller diameter, the safe depth of which is limited by the joint rather than the collapse strength. This condition will permit the use of a thinner wall to resist collapse, but in turn it will require a joint of higher efficiency in tension than that of the regular A.P.I. design. The need of better joints for casing is further substantiated by experience in several areas where oil strings, set to a depth of approximately 9,000 ft. and under internal pressures higher than 3,000 lb. per sq. in., consistently obtain considerable leakage through the threaded couplings. To meet these conditions the several manufacturers offer improved joints, mostly designed to obtain advantages offered by an upset, shouldered joint with a heavy power thread. To use an often-repeated expression, the ideal joint to meet these conditions would be one of a flush design with 100 percent joint strength. Such a requirement suggests the welded joint; and while neither operating technique nor welding material has advanced near to the point of perfection, from the experience in the field and in consideration of its economic advantage, it is believed that the welded joint has excellent prospects, and its development should be encouraged.

It is admitted that, from the single standpoint of tensile strength, there is no urgent demand for the development of welded joints for casing. But the demand is somewhat strengthened by the experience of leaking couplings in the deeper producing wells; and in view of the trend toward the use of flush-joint casing, the outlook for welded joints is brightened. The strongest argument in favor of welded joints is the economic one. And unless some unforeseen difficulty appears, it is believed that the development of welded joints for casing is entirely possible.

Natural Gas

NEW DESIGN OF A FRACTIONATING PLATE.—J. A. Campbell, in REFINER, vol. 15 (1936), No. 4, pp. 127–134.

This paper describes a new idea in absorption towers. As finally developed the new absorber contains 16 plates seven ft. in diameter in a vertical column; each of these plates has 6600 5/32-inch perforations drilled on 1-inch centers, these perforations being slightly countersunk. Into each perforation is dropped a loosely fitting "rivet" cast from a special alloy. Under the head of each rivet are cast four ribs, so that any gas passing upward through the perforation will be broken into four jets, or 26,400 such jets per plate. The shank of the rivet is cleft (like a clothespin) so that on bending out the two branches the rivet cannot be projected out of the perforation by the rising gas current. Each plate is provided with 12 overflow tubes extending 5½ inches above the plate and provided with collector pans 12 inches in diameter and 1½ inches deep, giving a froth depth of seven inches, which settles to three inches of oil when the gas is shut off.

In operation the rich gas which is to be stripped of gasoline is injected at the base of the tower under a suitable pressure (30 lbs.) and the absorber oil drops from above, as usual. When the absorber gets in balanced working order it is found that no oil drips through the perforations, being held back by the force of the gas, and to pass downward has to rise above the froth pans of the 4-inch open tubes. The general result is that the entering gas is split up into so many small jets that the oil and gas make a very intimate contact—much more intimate than is achieved by any other type of absorber. The amount of oil in circulation is cut in half.

In normal operation the rated capacity is attained without lifting the rivets, but if a sudden increase of gas is obtained the rivets lift and the gas jets are doubled in size, giving the absorber a 100 percent overload factor, with practically no additional pressure drop.

The new absorber has been installed in plants of widely different types of gas and in every case has demonstrated high efficiency. It is likely to have important applications in oil refining.

USE OF NATURAL GAS FOR CARBURETING BLUE WATER GAS.—C. D. Robinson, in NATURAL GAS, vol. 77 (1936), No. 19, pp. 511–515.

From the facts discussed in this paper it is concluded that, except for the presence of dust (which may be removed by filtering and scrubbing), the number of customer's complaints of outages and stoppages is somewhat less than when straight carbureted water-gas or coal-gas, or a mixture of these, is distributed through the mains.

LIQUEFIED PETROLEUM GAS.—W. H. Bateman, at Symposium on Industrial Fuels, A.S.T.M., Philadelphia, Jan. 21, 1936.

In reviewing the history and present status of the liquefied gas industry, it is pointed out that the greatest increase in the use of this fuel is occurring in lines other than domestic and gas manufacturing, as indicated by the following figures (in thousands of gallons):

Uses	Total 1934	Per cent 1934	Total 1933	Per cent 1933
Domestic	17,681	36.7	16,626	42.7
Gas manufacturing	6,290	13.1	8,318	21.4
Industrial and miscellaneous	24,202	50.2	13,987	35.9
Total	48,173	100.0	38,931	100.0
	100.0	.....	100.0	.....

Statistics also indicate that there are more than 13,000,000 families in the United States who live beyond the gas mains. If only 10 percent of this potential market is secured, the bottled-gas sales will represent a retail value of about $60,000,000 annually, with an investment of over $100,000,000 for gas-burning appliances alone. There are now in excess of 240,000 bottled-gas customers in this country with current sales increasing at an accelerated rate.

Liquefied gas produced from natural sources is almost unlimited in quantity. Its greatest handicap at present is one of geographical location which, up to this time, has prevented the widespread use from this source. In the past year commercial operations have been started on the conversion of butane into gasoline. The development of liquefied petroleum gas as a motor fuel might well retard this development although it is still too soon to tell just what effect this development will have upon the available supply of these gases.

Now that the major problems of manufacture have been overcome by refineries, this source is becoming an increasing factor in the supply of these products. As butane is becoming more and more valuable as an ingredient of motor fuel, it is extremely doubtful whether this gas will be available from refineries for a long period of time. However, propane will increase in proportion to the total marketed production of liquefied petroleum gas, as it is not possible to include this material in gasoline as we know it today. The greater production of liquefied petroleum gas from refinery gases will tend to eliminate the problem of distribution which has been a great factor in the industry.

Bottled gas is available in almost every section of the country. Practically all of the bottled gas is propane, although some small quantities of butane are used in the warmer sections of this country and in some of the foreign countries where its higher boiling point does not necessitate the application of heat.

The distribution of liquefied petroleum gases for industrial uses has in the past been limited largely to shipment in tank cars of 10,000-gal. capacity. The development of high-tensile-strength steels has, however, given impetus to the use of the tank-truck and it is now becoming common practice to haul relatively small quantities over a considerable distance in this manner. On the Pacific Coast truck and trailer units are hauling butane approximately 300 miles from the source of manufacture. As propane requires heavier tanks, because of its greater vapor pressure, it has not been economically feasible to haul much greater distances than approximately 100 miles, although longer hauls have been made in emergencies.

Petroleum Refining

COLOR RESTORATION OF GASOLINE AND KEROSENE IN THE FIELD.—J. B. Rather and L. C. Beard, Jr., before American Petroleum Institute, Tulsa meeting, 1936.

The discoloration of gasoline and kerosene initially refined to a water-white color, when held for some time in storage, has been an annoying and costly problem to the petroleum industry, largely due to the long storage periods entailed in export distribution and also to the difficulties involved in shipping discolored products back to the refineries for reconditioning. In domestic markets gasoline, several years ago, gave rise to the greatest amount of trouble; but the introduction of colored gasolines has, to some extent, ameliorated this situation. With kerosene, however, the trade is becoming more critical in demanding a colorless product.

To give some idea of the magnitude of the losses which might be sustained when kerosene goes off color in bulk storage, the following example is of interest. In India in 1928 there were generally marketed two grades of burning oil—one of which was white in color, and had satisfactory burning characteristics; the other was yellow in color, and a relatively low-grade product of poor burning characteristics. The price differential between these two grades was approximately one rupee (37 cents) per 10 gal. In the case of an 80,000-bbl. tanker this would entail a loss in the neighborhood of $140,000 if it became necessary to dispose of the discolored oil at this price reduction.

In their investigations of this problem the authors found that the discoloration is due to oxidation in contact with air and they directed their efforts to finding oxidation inhibitors that would act as color stabilizers; among such compounds are: thiocarbanilid, hydroquinone, resorcinol, pyrocatechin, pyrogallol, phloroglucinol, 1,2,4-trihydroxybenzene, butyl pyrogallol, alkyl substituted dihydroxybenzene, alkyl substituted polyhydroxybenzene, ethanolamines, urea, and thiourea. Many of these compounds are also effective inhibitors of the formation of gum in gasoline.

It was also found that certain of these compounds, pyrogallol for instance, would decolorize kerosene and gasoline that had gone off color in storage. The preferred practice of effecting this restoration is to dissolve 1 lb. of a reagent such as hydroquinone in 1 gal. of a suitable solvent, as *iso* propyl or ethyl alcohol and mix this with 2,000 to 15,000 gal. of oil, depending on the degree of discoloration and age of the oil; the cost is about one cent per bbl.

It is suggested that considerable savings in original refining costs might be effected by refining only to a point that will afford reasonable color stability, and then decolorize in the field any oil that may go off color.

CLAY TREATING OF MOTOR FUEL.—M. R. Mandelbaum and Paul F. Swanson, before American Petroleum Institute, Tulsa meeting, 1936.

The Gray, the Osterstrom, and the R. K. Stratford clay-treating processes are in use to the extent of more than 180,000 bbl. per day throughout the world. Of this, some 140,000 bbl. (operating and under construction) is in the United States.

Correlation of available data on the Gray process, which is the most widely used, is made difficult by differences in the oil treated, specifications to be met, and design limitations. This is reflected in clay life ranging from 800 bbl. to 27,000 bbl. per ton of fullers earth.

Data have recently become available on two high-pressure Gray process installations, one of which operates at a high, and the other at a low through-put rate (approximately five bbl. and one bbl. per ton per hour, respectively). The first plant, in connection with a 30,000 bbl. per day combination cracking unit operating on East Texas crude, has four Gray towers in parallel, and has attained a clay life of more than 27,000 bbl. per ton. This plant supplements clay treating with b.a.p. inhibitor, and reports that the inhibitor susceptibility of the clay-treated gasoline is almost double that of the unclayed cracked product.

The other plant uses two Gray towers in series, and at a clay life of more than 4,000 bbl. per ton produces a cracked gasoline that is remarkably stable as to color and copper-dish gum.

Other recent developments include the Gray treatment of cracked gasoline from topped Kettleman Hills crude, and installations in connection with units producing polymer gasoline. In the latter instance, clay life of 20,000 bbl. per ton has been obtained.

THE SOLVENT DEWAXING PROCESS.—W. P. Gee, W. Kiersted and B. Y. McCarty, before Am. Petrol. Inst., Tulsa, 1936.

In pointing out the essential requisites of an installation for dewaxing oils by the use of solvents, it is observed that a maximum yield of dewaxed oil is insured by two fundamentally sound principles: (1) the use of a solvent which can be accurately controlled as to solvent power in order to permit complete separation between wax and oil solution; (2) the use of filtration to separate sharply by mechanical means the precipitated wax crystals from the chilled oil-solvent solution.

The process in its present commercial form employs a mixed solvent including an oil solvent, chemically related to the oil, which will retain the oil in complete solution at the dewaxing temperature but will not exert excessive solvent action upon the wax content; and a wax anti-solvent, chemically dissimilar to the

oil, which will effectually eliminate any tendency of the wax to remain in solution at the dewaxing temperature. The wax anti-solvent, in addition to promoting crystal growth and wax precipitation, is also a material aid to filtration by reducing the viscosity of the oil solution.

Unfortunately for the industry, the solubility of different oils and different waxes is not the same. If this were the case, a single solvent possessed of sufficient selectivity to serve in itself as a solvent and anti-solvent might be suitable for all dewaxing purposes. Generally speaking, however, the higher the viscosity and the greater the so-called paraffinicity of an oil, the lower will be its solubility. The difficulty of securing a single solvent that will serve equally well for dewaxing all oils becomes at once apparent. A correct mixture of several solvents, on the other hand, permits a clean separation of oil solution from wax crystallized at any desired temperature of filtration.

Commercial 90 percent benzol is now used as the most suitable oil solvent due to its high solvent power for oil, low wax solubility, stability, and availability in commercial quantities at low cost. The ketones possess excellent properties as wax anti-solvents. Of these methylethylketone and acetone are the two wax anti-solvents now generally employed in commercial application of the process. Either can be used in any case, and the selection between the two is generally a matter of operating or investment economy.

The process is characterized by high yield of wax-free oil and low dewaxing differential (difference between dewaxing temperature and pour test). Plants now in operation dewaxing to 0 deg. F. pour test demonstrate that the wax cake removed by filtration contains practically no 0-deg.-F. pour-test oil. The practically complete separation of wax is accomplished, moreover, at a temperature substantially the same as the pour point of the dewaxed oil desired.

A list is given of 13 refineries using the process in different parts of the world.

Propane De-asphalting and Dewaxing of Mid-continent Residuum.—A. P. Anderson, H. O. Forrest and Lee Van Horn, before Am. Petrol. Inst., Tulsa, 1936.

This paper describes the design and operation of the propane de-asphalting and dewaxing plant at the Wood River refinery of the Shell Petroleum Corporation. The plant represents the initial commercial application of de-asphalting, and also includes the novel feature of continuous pressure filtration. The process consists of mixing long residuum with about four volumes of propane, settling asphalt, and then removing about 2½ volumes of propane. The remaining solution is chilled by self-evaporation with addition of propane; cooled by exchange, to maintain concentration; and is then filtered to remove wax, and all products are de-propanized.

The plant has been operated at design capacity of 2,450 bbl. per day of dewaxed oil since chiller-foaming difficulty has been overcome. Initial difficulty of pumping the wax cake was solved by adding a small quantity of solvent to the cake in the wax conveyor.

Filter operation has been highly satisfactory, utilizing a pressure differential of about 4 lb. maintained by propane vapor, and filter rates of 3 gal. to 4 gal. of dewaxed oil per square foot have been realized.

Pour test of dewaxed oil is consistently −10 deg. F., and subsequent solvent extraction and distillation produces cuts having pour points of 0 deg. F. or below, and no cloud when held at +20 deg. F. Average yields are about 78 percent de-asphalted and dewaxed oil, 3.5 percent asphalt, and 18.5 percent wax, with the unwashed cake containing about 30 percent of oil with reduction to 15–20 percent realizable with washing.

Petroleum Physics

Thermodynamics of the Cracking of Propane Gases.—Harrison G. Hays, in Oil and Gas Jour., vol. 34 (1936), No. 49, pp. 39–43.

The recent development of several processes for the commercial pyrolysis of natural and refinery process gases and the consequent polymerization of these gaseous cracked products to a high liquid content of olefinic and aromatic hydrocarbons has unfolded an entirely new vista, in so far as the increased profitable utilization of resources of natural gas is concerned. During past years only a fraction of the natural gas which has been produced has been used for industrial and domestic purposes, whereas a vast volume which has amounted to many millions of cubic feet per day has been irretrievably lost through the residue gas vents of the many natural gasoline plants throughout the country. It is interesting to consider that a large proportion of this hitherto wasted material is now finding its way into the engines of airplanes and automobiles as an important component of "poly" gasolines. Oil companies are, therefore, killing two birds with one stone, for they are simultaneously utilizing a waste product and making available a high octane number blending material which should decrease their finished gasoline production costs through a diminished use of expensive artificial antidetonants.

In order to polymerize saturated hydrocarbons such as occur in natural gas it is necessary first to render them unsaturated, i.e., to convert them into olefins. This is effected by pyrolysis or heat treatment in which portions of the hydrogen attached to the carbon nucleus is broken off so that these nuclei can recombine to form molecules of liquid gasoline.

In this paper the author gives a thermodynamical analysis of the reactions involved in the cracking of propane for the manufacture of polymerized gasolines, using natural gas as charging stock.

High-Temperature Viscosities of Liquid Petroleum Fractions.—K. M. Watson, Jerome L. Wien and George B. Murphy, in Ind. Eng. Chem., vol. 28 (1936), No. 5, pp. 606–609.

The capillary tube method was used to determine the kinematic viscosity between 100 deg. and 800 deg. F. of a series of liquid hydrocarbons ranging from pure benzene and *n*-heptane to lubricating oils and products from commercial cracking units. The data can be satisfactorily expressed by the equation, $\log(\log \mu/s + 1.7) = a(t+100) + b$, for temperatures above 210 deg. F.

On the basis of this equation a high-temperature viscosity chart was developed. A nomograph was developed permitting the estimation of the viscosity-temperature curve of a liquid from laboratory inspection data. Pressures up to 500 pounds per square inch had little effect on the kinematic viscosity in the range of the determinations.

The Joule-Thomson Coefficients of Propane.—B. H. Sage, E. R. Kennedy and W. N. Lacey, in Ind. Eng. Chem., vol. 28 (1936), No. 5, pp. 601–604.

In determining the thermal properties of hydrocarbons in the gaseous region, the Joule-Thomson coefficient is a powerful tool when known as a function of the state. The purpose of the present paper is to describe an apparatus developed to measure this property, to report upon the data obtained for propane, and to outline the usefulness of this measurement in thermal calculations.

Physical Constants of Polymerization Products of Unsaturated Hydrocarbons.—H. I. Waterman, J. J. Landertse and J. Ph. Makkink, in Jour. Inst. Petroleum Technologists, vol. 22 (1936), No. 151, pp. 333–340.

The authors have examined a series of polymer fractions obtained from a mixture of branched pentenes and compared them with the unbranched 2-pentene polymers. From the results as graphed it may be seen that in the case of the normal 2-pentene and the asymmetric methylethylethylene-trimethylethylene mixture the viscosity properties of the polymerization fractions are independent of the chemical structure of the pentenes used in the polymerization. The ramification of the pentenes in this case has no influence on the viscosity properties of the polymers obtained under analogous conditions. However, it must be remarked that the method used in comparing the viscosity-temperature curves is not a sensitive one. It is suitable for detecting the more important differences in the products.

Hydrocarbon Vapor Pressures.—Edwin R. Cox, in Ind. Eng. Chem., vol. 28 (1936), No. 5, pp. 612–616.

The saturated vapor pressures of all hydrocarbons with molecular weights over 30, whose data are available, can be correlated by three equations, if boiling point and critical temperature and pressure are known; and the latter can be calculated for the normal paraffin series.

Asphalt and Tar

Susceptibility of Asphalts to Temperature Change.—H. E. Schweyer, C. E. Coombs and R. N. Traxler, before Am. Soc. Testing Materials, Atlantic City, 1936.

The viscosity-temperature relationships of asphaltic materials are complex and no type of equation has been found that is of practical value over a wide temperature range. However, at processing temperatures where the asphalts have viscosities ranging from 1 to 5 poises and at service temperatures (15 to 35

C., 59 to 95 F.) a log-viscosity *versus* temperature plot is a straight line within the limits of experimental error. For these regions a new, simple and logical way of expressing susceptibility based on the percentage change of viscosity for a one degree rise in temperature is proposed, and is called the Asphalt Viscosity Index.

Using the Saybolt Furol viscosimeter for measuring consistencies between 1 and 5 poises (approximately 50 to 250 Furol seconds) and the falling coaxial cylinder viscometer for evaluating viscosities at service temperatures (15 to 35 C., 59 to 95 F.) the susceptibility of an asphalt in terms of absolute units can be determined very quickly.

Viscosity data in absolute units are given for a number of different paving asphalts both at the high "processing" and the low "service" temperatures. The Asphalt Viscosity Indices for each asphalt at both temperature ranges are recorded together with susceptibility factors for some of the asphalts calculated from penetration data. The indices of the various asphalts are greatly different in magnitude for the two temperature ranges and the relative order of susceptibility may change.

Data are given which indicate that the susceptibility of a viscous bitumen-filler mixture to temperature change is very nearly the same as that of the bitumen present.

EFFECT OF MINERAL FILLERS ON THE SERVICEABILITY OF COATING ASPHALTS.—O. G. Stricter, before Am. Soc. Testing Materials, Atlantic City, 1936.

Asphalt shingles and roll-roofing are made by impregnating felt with a relatively soft asphalt and then surfacing with an asphalt that is considerably harder, the latter being known as a coating asphalt. In recent years the practice has become general to mix finely ground slate, limestone, and similar mineral fillers with the asphalt to obtain a coating which is less affected by sunlight and less subject to plastic flow.

The effectiveness of fillers can be compared on the basis of equal volumes, or equal surface areas, or equal weights of fillers. In the present investigation the effects of fillers on coating asphalt were compared only on the basis of equal weights, since this is the simplest and quickest way to compare filled and unfilled coating asphalts. Accordingly, a variety of asphalt-filler mixtures were prepared on a weight basis and tested by exposure to weather in various parts of the country, and also to accelerated tests under controlled conditions. It was found that the durability of the coatings varied in different localities; samples exposed at New Orleans showed the most surface oxidation, followed by the tests at Washington, Buffalo, Manville and Chicago. The durability of the coatings also varied considerably according to the nature of the filler; mica, slate and talc seem to be the best and sand about the poorest. The investigation showed that the accelerated laboratory tests give results comparable to long exposures out of doors.

FOAMING OF ROAD AND ROOFING TARS ON HEATING.—H. Mallison, in ASPHALT UND TEER, vol. 36 (1936), No. 13, pp. 251–253.

The case sometimes arises where a road or roofing tar when heated on the job foams to an extraordinary extent, and when complaint is made to the factory no foaming can be observed when a retained sample of the original shipment is tested. After investigating the subject the author offers the following explanation: When a road tar is found to contain no more than the allowable amount of water (0.5 percent) there is no foaming, provided the water is in the form of relatively large drops that can settle to the bottom of the pot when the tar is heated on the job; in such case the water escapes in bubbles of steam which cause only spattering. But if the water is present in a finely divided form, or in particles so small that they do not run together and settle out, then when the tar is heated the particles are converted into vapor throughout the mass and the tar foams. In his experiments the author found that when a tar is moderately agitated with 0.2 percent of water the expansion in the foam test was only 17 percent, but when the same tar was run through a homogenizing machine the expansion was 40 percent. In another test with 0.5 percent water, moderate shaking resulted in an expansion of 40 percent, which was raised by homogenization to 126 percent. From this it is concluded that though a tar may conform to the foam test as it leaves the factory it may foam on the job if it comes into contact with water and is more or less homogenized by stirring or pumping. Experiment showed that even homogenized water may be settled out if the tar is allowed to stand awhile at a temperature of about 70 deg. C.

Use of Petroleum

CORROSION TEST METHODS IN USE OF LIQUID BUTANE AS MOTOR FUEL.—M. M. Holm, before Am. Chem. Soc., Kansas City, April (1936).

Experience in manufacture and sale of liquid butane for motor fuel service has shown that extreme care in avoidance of contact with possible contaminating materials is essential. The problem is peculiar to the specific equipment used for vaporization and carburetion of the liquefied gaseous fuel. In many cases, improper functioning of this equipment results from presence of such minute concentration of contaminant that detection by ordinary methods of analysis is impossible. A procedure is outlined for detection and qualitative identification of such contaminants. Results may be interpreted in terms of actual service conditions to which the fuel is to be exposed. An appropriate set of warning instructions is given for proper handling of liquefied gaseous fuels.

COMBUSTION OF MODERN GASOLINE.—Eduardo Ospina-Racines, in INGENERIA INTERNACIONAL, vol. 24 (1936), No. 5, pp. 142–145.

This paper is an exposition of the nature and characteristics of the combustion of motor fuels that are summed up in the "octane number." The subject is considered largely from the standpoint of the influence of octane number on market quotations of petroleum fuels, and its technical and economic application to the manufacture of gasoline.

A motor fuel of improved octane number may be obtained by mixing ordinary gasoline with benzol or anhydrous alcohol, or with the highly volatile products resulting from pyrolytic polymerization of hydrocarbon gases, such as propane or butane. At present the most important method of raising the octane number of gasolines is the addition of small quantities (maximum 3 cc. per gallon of automobile gasoline or 6 cc. for aeronautic engines) of tetraethyl lead.

The composition of commercial tetraethyl lead is given as follows:

Ingredients	Composition for Airplanes	Automobiles
Tetraethyl lead $Pb(C_2H_5)_4$	61.42%	63.30%
Ethylene dibromide $C_2H_4Br_2$	35.68	25.75
Ethylene dichloride $C_2H_4Cl_2$	....	8.72
Coloring substance	0.25	0.13
Impurities	0.94	0.96
Solvent	1.71	1.14

The effective ingredient of this mixture is the tetraethyl lead; the ethylene dibromide and dichloride serve to convert the lead into a gaseous form so that the lead will be eliminated with the exhaust, thus preventing deposition of metallic lead in the cylinders of the engine.

Tetraethyl lead can compete with benzol or other anti-knock liquids that cost more than six or eight cents a gallon.

Petroleum Substitutes

THE GASOLINE-SUBSTITUTE SITUATION IN ITALY.—Giovanni Coppa-Zuccari, in RIV. ITAL. PETROLIO, vol. 4 (1936), No. 37, pp. 3–5.

In view of the Italian law which prescribes that by the end of 1937 all automotive vehicles in public service shall be equipped to use fuel of national origin, the author looks into the question of whether the national resources will allow this requirement to be fulfilled, with particular reference to the use of "gasogenes" that convert solid fuel into combustible gas for direct use in automotive engines. The solid fuels that come into consideration are lignite, peat, wood, and wood charcoal. The Italian deposits of lignite contain approximately 100,000,000 tons of this mineral, which constitutes the only important reserve of fuel in Italy; it is costly to mine, and for use in automobiles would require processing at an expense that would be nearly prohibitive. As regards wood, the fact is that Italy is now importing 100,000 tons of this commodity for all purposes, which clearly means that Italian forests are not meeting the national demand for wood. If even half of the 75,000 Italian trucks and auto-buses, each traveling an average of 10,000 miles a year, are equipped to run by "gasogene" the forest industry would have to supply an overproduction of at least 500,000 tons of wood. Obviously, the national forests cannot rise to such a demand, even if reforestation were carried out on a grand scale; and a period of years would be needed to increase production to the required level. As regards peat, the visible supply is too small to be given much consideration.

In view of these facts the author concludes that the Italian law prescribing that all public automotive vehicles shall run on national fuel by the end of 1937 is "at least, premature."

THE ECONOMIC PROBLEM OF "FOREST GAS."—M. Friedwald, in REV. PETROLIFERE, No. 683 (1936), pp. 705–707.

The numerous vehicles propelled by "wood gas"—the so-called gasogenes—now to be

seen in large numbers on the roads and streets in many parts of Europe seem to indicate that wood is a serious competitor of gasoline. To show that this situation is in reality mere fiction the author quotes the following prices now ruling in France:

One liter of gasoline is the energy equivalent of 1.5 kilograms of wood charcoal made from 3 kilograms of wood.

Current prices are: gasoline 2.10 francs per liter; the equivalent quantity of wood charcoal costs 1.84 francs. If no account is taken of the gasoline tax the actual cost of the gasoline is 0.54 francs and the cost of the equivalent quantity of charcoal is 0.90 francs, and for plain wood 0.60 francs. The apparent ability of wood and charcoal to compete with gasoline is due solely to the fact that these forest products are untaxed. It is also to be considered that the above quoted prices for wood and charcoal are depression prices; any marked improvement in the demand for wood for automotive purposes would most likely increase the price of these gasoline substitutes.

Neglecting for a moment the question of price, the author considers the question of supply. The annual production of wood from all the forests of France is 30,000,000 steres (cubic meters), of which 11,000,000 steres are at present unmarketable; it is this surplus which the forestry interests desire to throw on the automotive fuel market. Eleven million steres of firewood are the equivalent of about 132,000,000 gallons of gasoline, or about enough to supply 70,000 industrial vehicles. If this untaxed fuel is substituted for taxed gasoline the treasury would lose 120,000,000 francs a year.

Petroleum Reserves

Precision Gage for Sub-Surface Pressure Measurements.—Paul G. Exline, before Am. Petrol. Inst., Tulsa, 1936.

The primary element of the gage here described is a corrugated tube forming a long bellows. External pressure applied to this bellows causes it to shorten its length; the pressure thus registered is measured with a high degree of accuracy.

During the past few years, the bottom-hole pressure gage has come to be regarded as a necessary part of oil-producing equipment. Great impetus has been given this feeling by the various regulatory bodies who, in their attempts to prevent unnecessary dissipation of reservoir energy, rely to a major extent upon pressure surveys in the various fields. The use of bottom-hole pressure data as a guide is of great value in determining the proper time for the installation of pumping equipment, thus permitting an orderly program of installation to be planned in advance. Investment interest, depreciation, and obsolescence of idle pumping equipment can all be reduced in this way. Accurate estimates of reserves in a field, necessary for planning a comprehensive program of development, can be made with reliable data on the pressure decline during the early history of the field. The bottom-hole pressure gage can be used not only to show when a field is being operated at maximum efficiency, but pressure contouring a field will yield much information on the reservoir structure itself. Much can be done toward the analysis of individual well behavior by studying its bottom-hole pressure under various conditions. The effective permeability of the sand surrounding the well, the precise determination of the density of the fluid column, the well capacity, and location of water can all be secured partially or completely with the bottom-hole pressure gage. Attention has recently been drawn to the study of "flow-string" efficiencies, a type of work which will become of increasing importance.

Petroleum Economics

Economics of Oil Producing Practice.—C. H. Lieb, before Am. Inst. Min. & Met. Engineers, Tulsa, 1936.

The speaker outlines the current important problems of the oil industry as follows:

Universal adoption of wider spacing, adapted to the peculiarities of each pool, unitization, and pressure maintenance as standard operating practices.

Education of public officials and the public indirectly interested in the oil business to the end that under the police power, the law of capture shall be so modified, certainly as to permit, and whenever possible so as to compel, rational drilling and producing practices.

Persistent and consistent efforts on the part of the industry to improve operating efficiency and achieve lower costs and wider margin of profit on about the existing price levels for crude and products.

A better standard of professional ethics among the engineers and other technical people engaged in the oil business, and education of the executives as to the benefits from the best practices.

Establishing proration on a more scientific basis. Basing allowables on well potentials or flat rates per well are thoroughly unsound from scientific or economic viewpoints. Proration should be the allowable per well coincident with a rate of withdrawal utilizing the reservoir energy to the greatest degree of efficiency. If the technologists in the industry can agree upon a uniformly accurate method of estimating reserves, perhaps allowables could be a factor of reserves.

Development of the Paraffin-Wax Industry.—Oskar Tokayer, in PETROLEUM PRESS SERVICE, vol. 3 (1936), No. 14, pp. 105–107.

The paraffin-wax business represents only a small fraction of the world's petroleum production—about 0.2 percent. But it is nevertheless a valuable oil refinery product and finds a market in practically all countries. The quantity of paraffin-wax production in any country bears no necessary relation to the quantity of oil produced. Thus, Venezuela oil yields very little paraffin-wax, whereas British India and Burma, which produce relatively little crude oil, are able to turn out relatively large quantities of wax. The United States produces about half the world's supply of paraffin-wax, but wax production does not appear to increase in the same proportion as oil production. This is perhaps due to a decrease in production of paraffinous crude and perhaps also to changes in refinery treatment.

On the marketing side the paraffin-wax business has distinctive features. Its wide and varied application is such that it is not affected to the same extent by factors which influence the trade in liquid oil products. Thus, if we examine the effects of the world crisis upon the consumption of gasoline and paraffin respectively, we find that these effects were quite different. In most countries gasoline consumption declined considerably, but an examination of the paraffin-wax figures indicates that the latter product showed a high degree of resistance to the crisis and that a steady level of demand was maintained. Its principal use, for candles, was probably affected very little, as candles are used perhaps even more during periods of depression than in periods of prosperity, both for lighting and for religious purposes. Again, the consumption of bread in the United States is said to have increased considerably during the depression, taking the place of more expensive foodstuffs. This would result in increased demand for waxed paper for bread-wrapping.

The most important outlet for paraffin-wax has always been for the manufacture of candles, which formerly absorbed almost the entire production. During the past few years the candle proportion to the total consumption has declined and may now be estimated at about 65 percent. On the other hand, quite a number of new uses for paraffin-wax have arisen. Among the most important of these uses is the impregnation of paper for packing food and drugs and for the manufacture of drinking vessels, and the incorporation of paraffin-wax in cables and polishes. It is also used in medical preparations and treatment, and in the compounding of cosmetics. All these uses should be capable of considerable development.

No comprehensive statistics of world production and world consumption of paraffin-wax are published; but careful investigation of conditions in individual countries enables us to make the following estimates:

	World Production	World Consumption
	In metric tons	
1931.....	430,000	450,000
1932.....	420,000	430,000
1933.....	445,000	490,000
1934.....	460,000	435,000
1935.....	440,000	450,000

As these figures show, production was less than demand during the crisis years, so that an appreciable reduction of stocks took place. Complete figures of stocks are not available, but in the largest paraffin-wax producing and consuming country, the United States, stocks declined from 232,592,000 lbs. (105,500 tons) at the end of 1930 to 114,675,000 lbs. (52,000 tons) at the end of 1935.

Taxing Oil to Help Coal.—Oskar Tokayer, in PETROLEUM PRESS SERVICE, vol. 3 (1936), No. 13, pp. 97–99.

The decline of the British coal industry has constituted one of the gravest problems of British economics. Much of the blame for this situation has been charged to competition of fuel oil and it has been supposed that the shift of many industries from coal to oil is due to the difference in the price. Hence, the notion arose that if oil were made more expensive the industries would shift back from oil to coal, with benefit to the coal mining industry. Subsequently a tax of 1d per gallon was put on fuel oil.

An examination of the facts now shows what

the results have been. Instead of decreasing, the consumption of oil, excluding fuel oil used in road vehicles, increased between 1933 and 1935 by about 280,000 tons, or 20 percent. In some directions the tax has driven out oil in favor of coal, especially in the case of power plants where the prime cost of power is the sole factor governing the type of fuel used; in these plants the tax of over £1 per ton was too great a handicap, notwithstanding the advantages of compactness, cleanliness and closer control associated with the use of fuel oil.

Aside from this case, the effects of the tax have been merely to add to the burdens of the industries concerned without benefiting the coal industry. In the case of gas works the necessity of enriching the coal gas with gas oil is still paramount. The glass industry has found that coal is much less advantageous than oil. The vitreous enameling industry, where temperature control is of vital importance, finds that the advantages of oil outweigh the tax, and the same is true in the melting and annealing of copper, where a low sulphur content is imperative. The bolt and nut industry, which is largely engaged in the export trades, reports that when using coal it cannot compete either in price or quality with continental oil-using manufacturers. The food industry affords a clear instance of the effect of the tax in merely increasing fuel costs without benefiting the coal industry. So outstanding are the advantages of oil in bakeries and other food factories that, notwithstanding the burden of the tax, the consumption of fuel oil in such factories has increased from approximately 55,000 tons to about 79,000 tons, an increase of about 44 percent. In another direction the struggling jute industry has been burdened to the extent of about £8,000 a year in increased cost of batching oil, which can in no sense be said to offer any sort of competition to coal. For all these reasons there is a rising agitation against retention of the tax.

General

Iso-pentane in Manufacturing 100 Octane Aviation Gasoline.—F. B. Neptune, H. M. Trimble and R. C. Alden, in OIL & GAS JOUR., vol. 34 (1936), No. 49, pp. 26–27.

This paper from the research department of the Phillips Petroleum Company calls attention to the general swing to higher octane aviation fuels and that this swing is being retarded by the fact that neither the aeronautic nor the petroleum industry is now prepared for a shift to 100 octane number gasoline. However, it appears that the aviation industry is lagging the most, as it is behind in the construction of suitable engines. When such engines are available for widespread use, a suitable fuel can be furnished in adequate quantity. Toluene blends offer definite possibilities, and toluene can be prepared in vast quantities from natural gas and refinery vapors. Then there are numerous synthetic hydrocarbons such as iso-octane di-isobutylene, cyclohexane and ethyl benzene, which merit consideration. And there is one hydrocarbon, which occurs abundantly and naturally in petroleum that has been almost completely overlooked. Iso-pentane is a major constituent of natural gasoline. It is estimated that 190,000,000 gallons of iso-pentane could be obtained annually by simple fractionation from the natural gasoline produced in the United States, and millions of gallons of "iso-pentanized" aviation gasoline have been made by the writers' company. But extended use of straight iso-pentane awaits the design of engines in which gasolines of high vapor pressure can be used. Still, much can be done with blends. Iso-pentane imparts desired volatility to iso-octane blends. Experiments reported by the authors show that, from the anti-knock standpoint, iso-pentane has a value ranging from 92 to 100 percent of that of iso-octane in making 100 octane number aviation gasoline.

Protective Equipment Used in Accident Prevention.—J. L. Risinger, before A.P.I. Div. of Production, southwest district, Shreveport, 1936 (Oil Weekly, 1936, p. 34).

There is a wide difference between an accident and an injury. An accident might be termed as an error in design, construction, operations, procedure or personal performance of duty, many of which occur without injury to persons and sometimes without damage to property, but never without cost to a company.

The modern conception of accident prevention is the elimination of these errors, and therefore their direct and indirect cost to a company, emphasizing in the interest of company and employee the injury phase. From this standpoint the author outlines protective equipment as follows:

1. The equipment of the individual with information as to correct operations and procedure in order that he might not only avoid the hazards which, in spite of guards, design and operations, constantly arise, but produce the greatest amount from his efforts at the least cost. An attempt to completely replace this phase of protection by material protection is following the path of least resistance. Guards will prevent machinery from pulling the cautious, thoughtful and informed workman into them and destroying him, but they will not fence out ignorance, indifference or insubordination.

2. Guards serve two purposes: to protect workmen against hazards and as a constant reminder to proceed correctly and therefore safely. No poster has ever been designed that will have the psychological effect upon the job, pride, efficiency, thoroughness and importance of correct procedure of the workman like a well regulated, clean, orderly and guarded place to work. If guards are used they should be standard, approved and dependable. Workmen will depend upon guards. Ineffective guards, therefore, create hazards rather than protect against them.

3. Standardized, correct and efficient design and operating procedure will not only reduce the frequency of injuries but will control the severity of injuries, increase production and reduce overhead cost.

4. Personal protective equipment serves two purposes: protection of the workman against injuries caused by error in procedure and protection against injury from hazards which, to date, design and methods in operating procedure have not been found to eliminate, or, if found, involve prohibitive cost.

Price of Crude Oil in Perspective.—Joseph E. Pogue, in BULL. AM. ASSOC. PETROLEUM GEOLOGISTS, vol. 20 (1936), No. 6, pp. 810–815.

The author views in perspective the broad sweep of the crude oil price structure since the inception of the American petroleum industry. The weighted average price of crude oil from 1860 to 1935 in the U. S. is compared with the price of 30 basic commodities (Warren-Pearson Index) using 1910–14 as the index base. The data thus arranged reveal two important features: the price of crude oil tends to conform in its broad movements to the prices of other basic commodities, and the price history has been written in five chapters, each influenced by a dominant development in the industry, so that the price history of crude petroleum may be tabulated as follows:

Phase	Period	Length (Years)	Price (Dollars per Barrel) Average	Range	Dominant Feature
1	1859–1877	19	4.28	0.49–16.00	Birth of industry
2	1878–1915	38	0.81	0.51– 1.19	Rise of Standard Oil Co.
3	1916–1920	5	1.94	1.10– 3.07	War expansion
4	1921–1926	6	1.61	1.34– 1.88	Inventory speculation
5	1927–1935	9	1.01	0.65– 1.30	Proration

The earliest period was marked by extremes of price fluctuations incident to inflation and other disturbances resulting from the Civil war. The second lasted 38 years and was characterized by considerable price stability and "normal" conditions. In this period production and transportation—refining—marketing activities had not yet been integrated. The third period coincided with war demands, credit financing and inflation that accompanied and followed the World War. The fourth period, 1921–26, covered a time of deflationary reaction to the abnormal rise of the preceding period. The fifth or proration phase is the logical outgrowth of the third and fourth cycles, which demonstrated the necessity for control of production.

The author calls attention to the fact that in the presence of competition price, in its causal rôle, exercises four functions.

(1) Price tends to equate supply and demand. (2) Price tends to integrate supply and demand, adjusting the component parts of one to the other. (3) Price tends to regulate the inflow and outflow of capital, the fundamental control of supply. (4) Price tends to repel or attract the fund of general purchasing power, the fundamental control of demand.

Under proration, price is relieved of the first mentioned function to a large extent, and partly so in respect to the second. But the effect of price upon capital movements and purchasing power is not altered by proration. Therefore, under proration, the innate price response to an artificial balance between supply and demand is limited and whenever price is forced above its critical point the result is valorization which is disruptive of equilibrium and can not be sustained. The future of crude-oil prices, with proration operative, will probably depend to a considerable degree upon the position of this critical level.

United States

	Daily Crude Oil Production bbl.	Daily Runs to Stills bbl.	Total Motor Fuel Stocks bbl.	Imports for week bbl.	California Shipments East for week bbl.
Week ending May 30....	2,935,000	2,935,000	70,974,000	1,570,000[2]	193,000
	443,500[1]				
Week ending June 6.....	2,936,500	2,950,000	70,369,000	631,000[2]	74,000
	446,500[1]				
Week ending June 13....	2,963,500	2,975,000	70,668,000	1,640,000[2]	218,000
	440,000[1]				
Week ending June 20....	2,963,400	2,950,000	69,214,000	888,000[2]	240,000
	439,150[1]				

Underlined figures indicate improvement in statistical position—decrease in production, runs to stills, gasoline stocks and imports.

[1] **Estimated total production of the East Texas field.**

[2] **Import figures include all oil imported, for domestic use and in bond for re-export, it being impossible to make the separation in weekly statistics.**

Undistributed Profit Tax Bill Enacted

ON June 20 Congress passed the Compromise Tax Bill and sent it to the President for signature. The principal features of the new tax bill, which will raise some $800,000,000 in its first year of operation according to tax experts, relate to the revision of corporate taxation. The changes in corporate taxation are so radical that doubt has been expressed as to the validity of the new law. The principal provisions affecting the corporations are:

1. A normal tax on corporations, ranging from 8 to 15 percent on all net earnings.
2. A surtax on undistributed adjusted net income not paid to stockholders amounting to:
   7 percent on the undistributed profits not in excess of 10 percent of the adjusted net income.
   12 percent on the undistributed profits in excess of 10 percent and not in excess of 20 percent of the adjusted net income.
   17 percent on the undistributed profits in excess of 20 percent and not in excess of 40 percent of the adjusted net income.
   22 percent on the undistributed profits in excess of 40 percent and not in excess of 60 percent of the adjusted net income.
   27 percent on the undistributed profits which are in excess of 60 percent of the adjusted net income.

The new tax bill provides for the lessening of the undistributed earnings tax on undivided earnings of corporations with a total of under $50,000.

Prices Steady

WHILE during June the price trend of motor fuel and of other petroleum products continued firm with but few declines, seasonally the prices should have been advancing, and hence the current price structure can be interpreted as being distinctly unsatisfactory. Huge overproduction, continued extensive drilling operations, record-breaking runs to stills and vast gasoline stocks—all have contributed recently toward the present unsatisfactory economic position of the oil industry, which should, at this time, be in excellent condition in view of the unusually large domestic demand for motor fuel. As the summer season progresses it becomes more and more obvious that unless crude oil production and runs to stills are radically curtailed, a break in crude oil refinery gasoline prices is inevitable in the fall, in which case the industry will forfeit such profits as it may derive during the heavy motoring season.

During June retail prices throughout United States continued firm and unchanged, while the summer season served, at least temporarily, to eliminate the threatened price wars in several localities. Tank wagon/service station motor fuel prices per gallon, regular grade, including all taxes, in representative districts at the end of June were: 14.2/19.2 cents in metropolitan New York; 14.0/17.5 cents in Newark, N. J. (off 0.3/0.3 cents per gallon); 13.5/17.0 cents in Boston, Mass. (up 1.0/1.0 cents per gallon); 12.0/15.5 cents in Providence, R. I.; 15.5/17.5 cents in Chicago; 17.5/19.5 cents in Ohio; 17.0/18.0 cents in San Francisco; 16.5/17.5 cents in Los Angeles; 15.0/19.0 cents in Oklahoma; 14.0/18.0 cents in Dallas and Fort Worth (up 0.5/1.0 cents per gallon) and 14.0/18.0 cents in Houston, Texas, with third grade gasoline in East Texas area very firm at 13 to 14 cents per gallon at independent service stations, due principally to very heavy demand attributable to the Dallas Centennial Exposition; 15.7/17.7 cents in St. Louis; and 19.5/22.0 cents in Montreal, Canada; all with a 2-cent differential for the premium grade.

Refinery gasoline quotations lost another 1/8 cent per gallon in June, after a similar decline in May. Refinery gasoline was quoted on June 20 at 4¾–5 cents per gallon for 58–60 U.S.M. grade, 62.9 and below octane rating in Group 3, Oklahoma market; 63.0–67.9 octane rating, U.S.M., regular grade, was quoted at 5⅜–5⅝ cents per gallon; and 68 and above octane rating, U.S.M., was quoted at 6–6⅛ cents per gallon. East Texas refinery market continued particularly firm during June and at the end of the month the third grade gasoline eligible for interstate tenders was quoted at 4¾–4⅞ cents per gallon, while third grade gasoline for intrastate commerce brought only 4¾ cents per gallon at refineries for truck sales, the improvement being due to higher local demand in connection with the Centennial Exposition at Dallas and also to the improvement in proration enforcement in the East Texas field. On the East Coast at Bayonne, U.S.M. grade, 60.0–64.9 octane rating gasoline remained unchanged during the past month at 6½ cents per gallon (3.84 cents gold *), though the accelerated seasonal demand will probably push this price to 7 cents per gallon early in July. Gulf Coast quotations for export continued unchanged during the past month and on June 20 grade 58–60 U.S.M. was quoted at 5 to 5⅛ cents per gallon (3.02 cents gold *).

Natural gasoline market quotations reached their seasonal low in June, losing ¼ to ½ cent per gallon from the prices of the preceding month, and being 1½ cents per gallon below quotations in February, 1936; ½ cent per gallon below quotations in March and April, 1936; and ½ cent per gallon below the quotation in June of 1935. On June 20 grade 26–70 was quoted at 2½ cents per ballon (1.70 cents gold *) in Oklahoma; at 2¼–2⅜ cents per gallon (1.37 cents gold *) in North Texas; and at 2⅞–3 cents per gallon (1.73 cents gold *) in North Louisiana.

Kerosene prices again weakened in June, declining ¼ cent per gallon, but were due to advance in July with the harvesting season in full swing. On June 20 grade 41–43 w.w. was quoted at 3¾–4 cents per gallon in Group 3, Oklahoma market; and at 4⅞ cents per gallon (2.88 cents gold *), unchanged, on the East Coast at Bayonne. Gulf Coast prices for export remained firm and unchanged and on June 20 kerosene was quoted at 3⅞ cents per gallon (2.92 cents gold *) for 41–43 p.w. grade, and at 4 cents per gallon (2.36 cents gold *) for 41–43 w.w. grade. On June 20 No. 1 p.w., 38–42 grade furnace oil was quoted at 3½–3⅝ cents per gallon, ⅜ of a cent under the preceding month; and U.G.I. grade gas oil was quoted at 2½–2⅝ cents per gallon, off ⅛ cent per gallon, all in Group 3, Oklahoma market.

Imports and Exports

DURING April of 1936 total gross imports of crude petroleum and all its products into the United States amounted to 4,870,000 bbl. (162,200 bbl. per day), as compared with 4,406,000 bbl. (142,000 bbl. per day) imported during March; out of this total during April, 3,106,000 bbl. (103,600 bbl. per day) were imported for domestic use and 1,764,000 bbl. (58,800 bbl. per day) were imported in transit, either for refining and re-export or for use in vessels in foreign trade. During the preceding

* **U. S. Dollar at 41 percent discount.**

month, March, 2,730,000 bbl. (88,000 bbl. per day) were imported for domestic use and 1,676,000 bbl. (54,000 bbl. per day) were imported in bond as indicated above. During April, 1936, the net imports for domestic use of 103,600 bbl. per day were 4.43 percent under the former federal allowable of 108,400 bbl. which was effective under N.R.A.

Exports of crude petroleum and all its products during April of 1936 continued at a level about 80,000 bbl. per day below the exports during the second half of 1935, when the exports were favorably influenced by war threats in Europe and the Far East. During April, 1936, the exports reached 10,025,000 bbl. (334,000 bbl. per day), as compared with 8,932,000 bbl. (288,000 bbl. per day) exported in March, 1936, an increase of 16.0 percent in the daily rate. The April, 1936, exports were 24.2 percent above the shipments of April of 1935, a low export month, when 8,081,000 bbl. (269,000 bbl. per day) were shipped. Exports of crude oil from United States during April of 1936 reached 3,743,000 bbl. (124,800 bbl. per day), as compared with 3,155,000 bbl. (101,600 bbl. per day) shipped in March of 1936, an increase of 22.85 percent; in April of 1935, 3,776,000 bbl. (125,800 bbl. per day) of crude oil were exported. In April of 1936 crude oil exports constituted 37.3 percent of the total exports of all petroleum products.

During April of 1936 the gross value of exports of crude petroleum and all its products amounted to $20,548,524, as compared with the gross value of all petroleum imports of $3,435,435, leaving, therefore, a favorable balance of $17,113,089. Gasoline, natural gasoline and naphthas led in the value of exports in April of 1936, their exports being valued at $5,738,050; followed by lubricating oils and greases valued in that month at $5,385,603; followed by crude oil valued at $5,029,051; by fuel or bunker oil for vessels in foreign trade (not included in domestic exports) valued at $2,722,199; by gas and fuel oil valued at $1,752,665; by kerosene valued at $1,095,312; and by residual fuel oil valued at $795,075. Of fuel or bunker oil used in vessels in foreign trade, American vessels used 1,183,359 bbl., valued at $1,172,354, while vessels of foreign registry used 1,459,310 bbl., valued at $1,549,845. The above import figures include imports in bond, and after such imports valued at $864,387 are excluded, the net favorable balance for the United States for the month of April, 1936, is $17,977,476.

Crude Production and Runs

CRUDE oil and natural gasoline production during May of 1936 continued in an excessive and uneconomic volume of about 3,135,000 bbl. per day, thus endangering the price structure for crude oil and refined products, the break being delayed only by the anticipated record-breaking consumption of the coming summer months. The May, 1936, crude oil and natural gasoline production was 371,000 bbl. per day above the production in May of 1935, an increase of 13.41 percent. The largest proportion of overproduction was derived, as in the preceding month, from Louisiana, which exceeded its quota by 1,774,000 bbl., or by 33.6 percent; Texas overproduced 1,173,000 bbl., or 3.34 percent; California fields overproduced 979,000 bbl., or 5.80 percent; while smaller overproduction was recorded in Oklahoma (231,000 bbl., or 1.38 percent) and Kansas (209,000 bbl. or 4.49 percent). Similar overproduction extended into the first three weeks of June.

Crude oil runs to stills during May, 1936, averaged about 2,940,000 bbl. per day, 122,000 bbl. per day above the runs to stills during the preceding month, April of 1936, when 2,818,000 bbl. were processed per day. Crude oil runs to stills in May of 1935 averaged 2,594,000 bbl. per day, thus indicating that during May of 1936 crude oil runs were 346,000 bbl. per day above the runs in the corresponding period of 1935, an increase of 13.35 percent, as compared with an increase in the demand for crude oil products not exceeding 10 percent to-date, which clearly shows the absurdity of the present situation. Total stocks of all petroleum products increased 2,314,000 bbl. during April, 1936, to a total of 551,119,000 bbl., indicating a daily gross addition to stocks of 72,000 bbl. per day.

Indicated domestic demand for motor fuel during April, 1936, averaged 1,294,000 bbl. per day, 11.85 percent above the average during the preceding month, when 1,157,000 bbl. were consumed per day; the domestic demand during April, 1936, was 82,400 bbl. per day above the domestic motor fuel consumption in April of 1935, an increase of 6.80 percent; it was also 194,000 bbl. per day above the domestic motor fuel consumption in April of 1934, an increase of 17.64 percent. During April of 1936, 84,000 bbl. of motor fuel per day were exported from the United States, 61.50 percent above the daily motor fuel shipments of the preceding month; 71.3 percent above the motor fuel exports in April of 1935; but 7.08 percent under the motor fuel exports in April of 1934.

On May 1, 1936, motor fuel stocks at refineries, plants, terminals and in transit, inclusive of natural gasoline, amounted to 78,567,000 bbl., a withdrawal from storage of 471,000 bbl. as compared with stocks on hand on April 1, 1936, indicating that during April motor fuel demand exceeded supply by 15,700 bbl. per day.

BASIL B. ZAVOICO

Gulf Export Prices for Major Oil Products

Products		Cents per Gallon			
		May 20	May 27	June 3	June 10
Gasoline:	U. S. Motor	5½	5¼	5¼	5¼
	64/66-375 E.P.	5¾	5½	5½	5½
	59 Octane & below	5⅝	5⅝	5⅝	5⅝
	65 Octane & above	6⅛	6⅛	6⅛	6⅛
Aviation Gasoline: (Tank-car F.O.B. Ref.)	73 Octane & above	10	10	10	10
Kerosene:	44 w.w.	4¼	4¼	4⅛	4⅛
	41–43 w.w.	3⅞	3⅞	3¾	3¾
	41–43 p.w.	3⅞	3⅞	3¾	3¾
Gas oil:	26–30 translucent	3⅛	3⅛	3⅛	3⅛
	30 plus translucent	3¼	3¼	3¼	3¼
Fuel oil:	Grade C Bunker (per bbl.)	$ .90	$ .90	$ .90	$ .90
	Cargo lots (per bbl.)	$ .80	$ .80	$ .82	$ .82
	Diesel oil (per bbl.)	$1.50	$1.50	$1.50	$1.50
Lubricating Oil: (New York Export Market)	Bright Stock No. 8	28	28	28	28
	Bright Stock No. 6½	27½	27½	27½	27½
	Warren E.	22	22	22	22
	600 Unfiltered	20	20	20	20
	650 Unfiltered	21	21	21	21
	600 Flash s.r.	22	22	22	22
	650 Flash s.r.	24½	24½	24½	24½
	Neutral 200 No. 3	27½	27½	27½	27½
	Neutral 150 No. 3½	24	24	24	24
So. Texas:	Red oil 500 No. 5–6	7¼	7¼	7¼	7¼
	750	9	9	9	9
	1200	9¼	9¼	9¼	9¼
	Pale oil 500	7⅞	7⅞	7⅞	7⅞
	750	9	9	9	9
	1200	9½	9½	9½	9¼
Crude Oil:	East Texas crude delivered at Gulf port for Export	$1.36	$1.35	$1.35	$1.35
	Venezuela	.83	.83	.83	.83
	Trinidad crude	.85	.85	.85	.85
	Panuco crude	.73	.73	.73	.73

Freight Rates

	May 20		May 27		June 3		June 10	
(Shillings per ton)	Dirty	Clean	Dirty	Clean	Dirty	Clean	Dirty	Clean
Calif.—U. K. or Continent	20/6	21/–	20/6	21/–	20/6	21/–	20/6	21/–
Gulf —U. K. or Continent	14/–	15/–	14/–	15/–	13/–	15/–	14/–	15/–

SHIPPING

QUESTIONS have been asked in the British Parliament concerning the construction for British owners of tonnage on the Continent. Particular interest has been aroused due to the large contracts which the Unilever Company have been placing in Germany in order to take care of frozen credits. Most of these tankers have gone to Norwegian owners. There is a class of owner in Great Britain who, in any case, still prefers to purchase his coastwise tankers in Holland because these are standardised, because they are—in spite of the fact that the guilder remains on gold—reasonably priced, and because there still remains more experience in small coastwise tanker construction in Holland than in England. This is attributable to the fact that the big oil companies have not done a great deal of small coastal tanker construction, preferring, rather, to leave it to the tramp.

Of steamers and motorships of 100 tons gross and over, shown in the returns of the Registrar General of Shipping & Seamen as having been built abroad during the last two years and subsequently registered in the U.K., one with a gross tonnage of 287 was shown as having been built abroad and subsequently registered in Britain. She is one of an interesting fleet of four ships which may be taken as typical of ships of this class now operating on tramp routes. The four ships in the fleet were built respectively in 1931, 1934 and two in 1936. The newest ship has a deadweight tonnage of 400 tons, a total bunker capacity of 10 tons, and dimensions 141.3 ft. x 23.5 ft. x 9.8 ft. The draft on an even keel is nine ft., one inch, and she has a speed in service of about 9½ knots on a single screw driven by a 4-cycle Diesel developing 300 h.p. at 300 r.p.m. The oldest vessel of the fleet was completed in 1931 and is a 230 tonner with dimensions 114.5 ft. x 22.15 ft. x 8.8 ft., the draft being eight ft. and the speed eight knots. The power is about 200 h.p. at 300 revolutions. Each of these vessels is fitted for carrying petroleum in bulk. It is on the Continent and particularly in the Baltic that the small Diesel-engined tanker seems to have achieved its greatest popularity. There is a reason for this because many of the ports to which petroleum products have to be taken are otherwise almost inaccessible by land. Many of these small ships, although intended for service in the Baltic, are successful in obtaining charters in other parts of the world. For example, the Oresunde yard recently built a vessel called the BELLATRIX, a sister ship to the DALANAS, built at Trelleborg slightly earlier. The BELLATRIX obtained charters between the Mediterranean and Black Sea ports. These little ships are very stoutly constructed and some of them encounter such heavy weather on passage as to have been posted as missing, only to turn up later, thanks to excellent construction.

There has not been much activity in new tanker construction or ordering during the last few months. The long expected admiralty orders for navy tankers have not materialised. The Standard Oil Company of California has placed an order with the Wilton yard for a 12,000 tonner through its subsidiary, the Standard Pacific Petroleum Company, the Hague. A whale oil refinery of 22,000 tons is to be built in Germany, and Unilever have ordered a large whale oil refinery from a German yard to be completed next year.

Attention was called in these columns recently to the interest which British shipbuilders were displaying in the European activities of the Standard Oil Co. of California. There was a thought that new tonnage might be placed to assist in the moving of refined products from the Bahrein Islands enterprise. So far, such hopes have turned out to be rather optimistic and Germany is the only country to date which has benefited, for a ship of 17,000 tons dw. has been placed at the Krupp Yard at Kiel. It is reported that another large American oil company is about to place an order in Germany. Socony-Vacuum have also been in the market recently and this time have gone to Denmark and the Odense Yard is now building a 10,200 ton tanker for delivery in March of next year at a cost of between 3,000,000 and 4,000,000 kroner. Contracts for tankers, fewer during the last weeks than was the case earlier in the year, have been featured by the ordering of ships for American companies or their subsidiaries.

A Norwegian New Jersey Standard subsidiary has placed a small ship only 56 ft. in length, this being the latest of an increasing number of small tankers for coastwise service placed during the last year. Tramp tankers continue to make numerical progress and the owning of such ships continues to have what appears to be a fatal fascination for Norwegian shipowners. Early in May came notice from Oslo of a tanker-owning company being registered with a capital of 700,000 kroner, the name being Skibs A/S Lampas. This company has acquired a contract for a motortanker of about 14,500 tons dw. to be built at Gotaverken and delivered at the end of the year at a price of 2,775,000 kroner. A new company has also been registered at Moss under the name of Skibs A/S Tankexpress with 600,000 kroner. This company has placed an order with Gotaverken for a 15,000 ton tanker for delivery in March of next year.

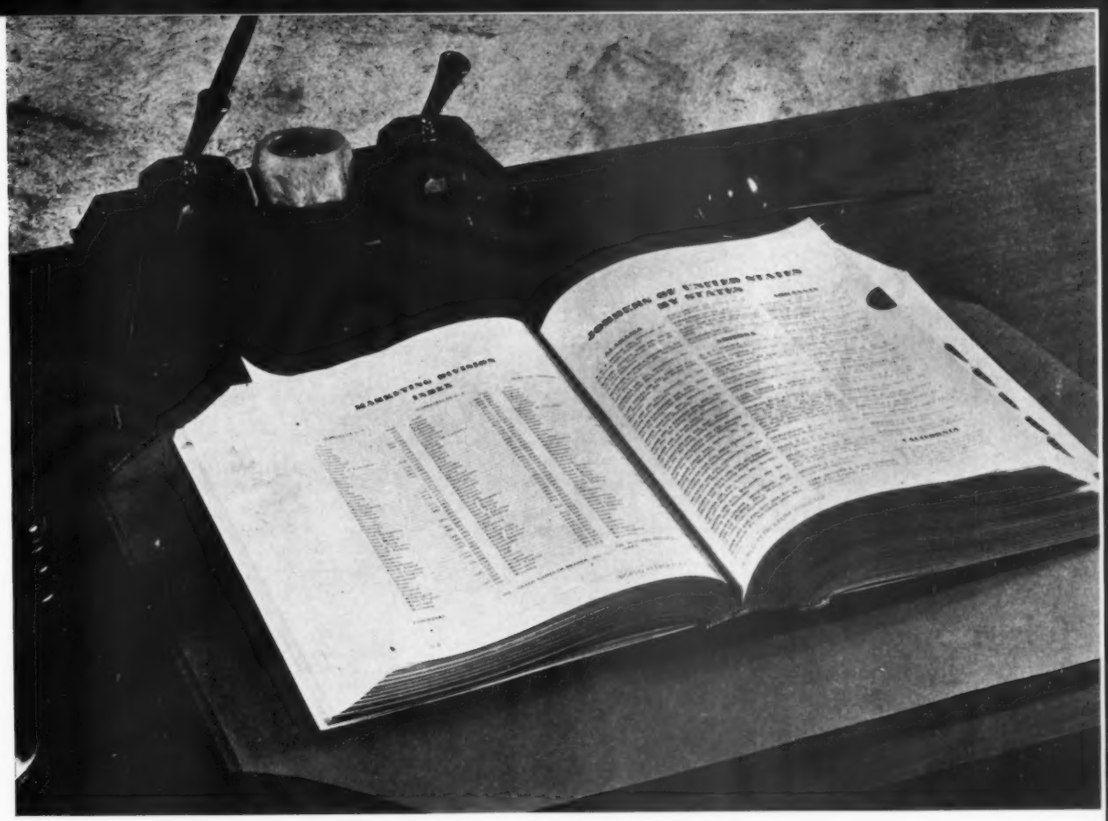
It is reported in London that the Anglo-American Oil Co. are likely to be in the market for some tankers in the near future, and this is a reasonable surmise when the date of their existing motorship fleet is taken into account. It is stated also that two small tankers are likely to be placed in the near future. These, it is expected, will be Diesel-driven. The Diesel engine continues to be as popular in tank ship work as ever.

Tanker men in Europe have been interested recently by the trials in Baden, Switzerland, at the Works of Messrs. Brown Boveri, of the Velox steam generator, a scheme for the use of which has been prepared for tank-ship operation. This steam generator has what may be called a Diesel-like flexibility as regards acceleration. It can use boiler oil and may be placed immediately alongside the turbine which it drives. To use a completely non-technical expression, it may be likened to a species of fuel valve. The Velox steam generator is a steam generator with pressure firing, very high flue gas velocities, entirely automatic governing and gas turbine driven blower. The driving medium for the gas turbine is the flue gas from the boiler itself and the blower serves to produce and maintain the superpressure in the combustion chamber. The object of this method of construction and operation, which differs completely from previous practice, is to produce a steam generator having smaller dimensions, less weight, higher efficiency, greater flexibility and more capable of being rapidly started than previously known boilers, and also to allow for a better adaptation of steam generation to prime mover, both as regards construction and operation

The Velox steam generator actually is not a steam boiler in the original sense of the word, but rather a steam producing machine. It is not necessary here to go into any technical details, but it may be mentioned that a typical layout in a generator engine-room shows that, in conjunction with a geared turbine set, it is one of the most compact forms of power-plant available. Little is known about its operation at sea at the present moment, for it has only been applied as a kind of auxiliary boiler on a French passenger liner, apart from naval work for which there is no data available. It is to be noted, however, that on the French ship it carries out the work previously done by a group of ordinary Scotch boilers. It can be started from cold in about 12 minutes and its technical correctness has been established.

Provided that the first cost is not too high, nor overhaul costs too excessive, and provided it is capable of being overhauled by ordinary sea-going engineers, it should have a reasonable future. The Velox steam generator should appeal to the American tank-ship operators who have already had satisfactory experience with high pressure watertube boilers and geared turbines in a number of ships employed in coastwise trade. One of the newest of these, the R. P. RESOR, has attracted particular attention in Britain. The position of her boilers with regard to the turbine and the shafting shows that American marine men are disposed to approach the problem of steam-generator operation without paying too much attention to preconceived ideas. It is for " reason that the Velox should make a strong appeal.

A. C. HARDY



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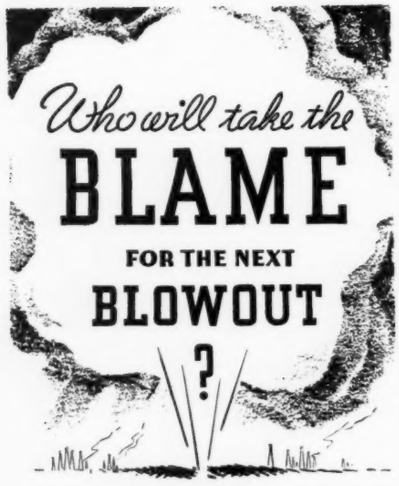

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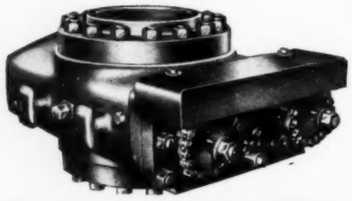

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Official Figures for Soviet Oil Operations

1936	Crude Production (bbl.)	Daily Average (bbl.)	Runs to Stills (bbl.)	Drilling (feet)
January	16,353,400	527,529	13,993,000	509,950
February	15,278,200	526,731	13,055,000	516,150
March	16,340,800	527,122	13,860,000	566,300
April	15,100,000	503,305	13,600,000	610,000
May	15,550,000	501,670	13,700,000	560,000
Total 5 months 1936	78,622,400	517,253	68,208,000	2,762,400
Total 5 months 1935	69,547,800	460,582	56,096,300	1,896,676
Total 1935	176,688,100	497,713	146,705,100	4,868,465
Quota 1935	212,310,000	580,082	171,500,000	5,214,000
Quota 1936	213,500,000	584,931	175,000,000	7,100,000

Crude conversion: seven bbl. = one ton.

OPERATIONS in two divisions of the Soviet oil industry (production and runs to stills) continued to show improvement during May over the preceding month. Crude production of all Soviet fields increased 2.5 percent as compared with April and, for the first time in many years, production at Grozni was accelerated—the figures for May representing a seven percent increase over April production. As the decline of Grozni has been an alarming factor since 1931 this increase is significant, particularly in view of the new discoveries at Daghestan which are practically certain to effect the long-awaited turn in the tide at Grozni.

During May the plan for operations was fulfilled 91.7 percent, as against 89.7 percent fulfillment in April. Of all Soviet Heavy Industries, only the output of electrical power approached plan fulfillment in May (99 percent), followed by production of pig-iron (97.9 percent) and steel (95.2 percent), all other industries having operated either on a level with oil or below.

The portion of the plan for the current year fulfilled by the Soviet oil industry up to June 1 amounted to 40.3 percent, compared with 35.1 percent for the same period of last year. Among the other industries, output of locomotives and production of superphosphates made the highest showings with 51.3 and 50.0 percent respectively. All others were about on a par with the oil industry, notable exceptions being production of coal at 39.3 percent and roller-bearings at 34.4 percent fulfillment of the plan for the year.

Only Sakhalin fields operated above plan in May, attaining 102–106 percent fulfillment on individual days. Other Soviet fields reached the following fulfillment figures in May: Baku, 85–101 percent; Grozni, 84 percent; Maikop, 71 percent; Emba, 75 percent; Bashkiria, 58–77 percent; Middleasia, 65–75 percent; Turcomanneft, 65–80 percent.

AT BAKU, as well as at other Soviet fields, flowing wells continue to provide the bulk of the crude produced, mechanical production still being reported as unsatisfactory. The

Soviet Oil Exports
(tons)

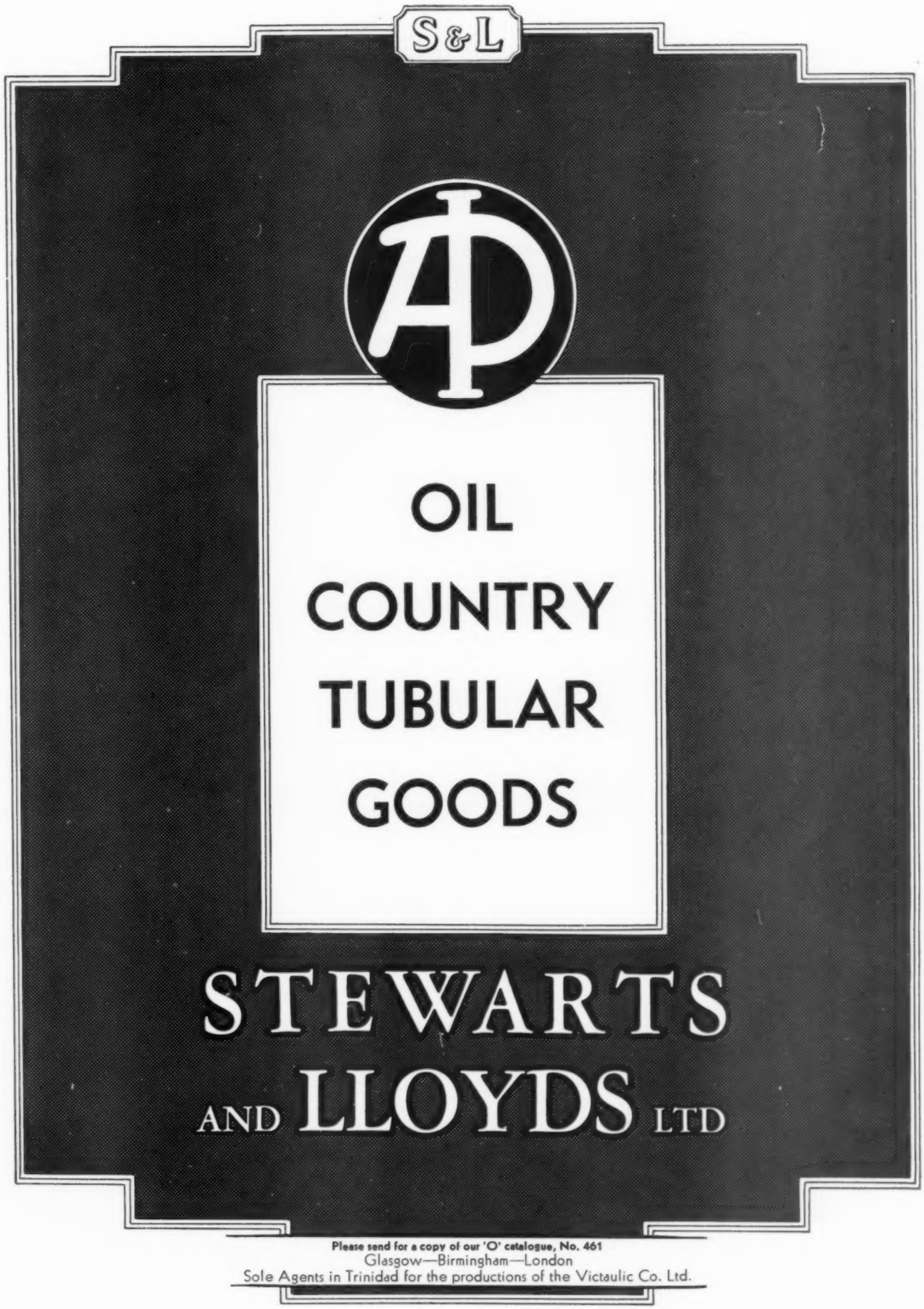
January	222,643
February	278,687
March	247,375
Total I Quarter 1936	748,705
Value in Rbl.	9,590,000
Total I Quarter 1935	841,831
Value in Rbl.	10,270,000
Decrease in quantity	11.0 percent
Decrease in value	6.7 percent

Soviet Exports by Products
(tons)

	Jan.–March, 1936	Jan.–March, 1935
Crude oil	124	59
Gasoline	131,350	187,911
Kerosene	89,611	118,752
Lube oil	75,797	60,485
Gas oil	124,568	123,680
Diesel oil	21,308	17,967
Fuel oil	304,899	330,280
All others	1,148	2,697
Total	748,705	841,831

Soviet Exports by Countries
(tons)

	Jan.–March, 1936	Jan.–March, 1935
France	112,397	81,734
Germany	73,907	94,915
England	88,594	91,300
Sweden	39,800	49,146
Denmark	35,305	36,182
Belgium-Luxemburg	29,231	28,354
Italy	22,170	75,327
Japan	18,839	18,460
Spain	14,497	51,919
So. Africa	13,769	11,390
All others	299,889	303,727
Total	748,705	841,831



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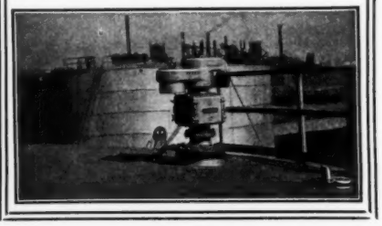

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Lokbatan field of Baku, discovered about three years ago, has produced, in all, some 17,500,000 bbl. of crude, all of which has been obtained from flowing wells. In 1933 the first gusher of this field yielded, at times, between 70,000 and 140,000 bbl. of crude daily. The field is now incorporated under the Mikoyan group and has 150 wells, all of which are flowing. Production for the first four months of 1936 has been far in excess of the total for 1933 (the year of its discovery). In the southern part of the Surakhani field of Baku two new wells were recently opened, flowing 3,500 bbl. of crude per day each. Surakhani has been under operation for many years and was only recently considered as nearing exhaustion. These two new wells opened in the south have expanded the field over some 20 hectares of new territory where 15 wells are being drilled, all of which, it is anticipated, will be flowing wells. New wells flowing about 1,000 bbl. of crude daily were opened at Kergez from depths of about 1,500 ft. At Bibi Eibat wells flowing 1,000 and 2,500 bbl. of crude per day have opened the seventeenth layer for operation, and at the Asisbekoff group of fields a well flowing 4,000 bbl. of crude has come in from a depth of some 7,000 ft.

Likewise at Grozni flowing production predominates among the new discoveries. In a recent discovery in the southern wing of the Terski hills, which is an extension of Molgabek, new wells flowing from a depth of about 3,000 ft. have opened a new producing layer 300 ft. wide. At Old Grozni, too, new gushers have come in from depths of 7,000 ft., which is the greatest depth on record for Grozni, and a new gusher came in at an old well which had been idle for over seven years when the pipe from this well was being extracted for use elsewhere.

At Utchkizil, about 15 kilometers (nine miles) from the Haudag field of Middleasia, a new well came in flowing between 3,500–4,000 bbl. of crude daily of .964 gravity. At Haudag, during last year, a new well was opened flowing 70,000 bbl. of crude per day from a depth of 1,500 ft. At Turcomanneft, Neftdag well 13 B has already yielded over 2,000,000 bbl. of crude during the past 13 months since its discovery and several new wells are now drilled and ready for testing. These new wells, expected to come under operation shortly, will probably increase the total daily flowing output of the field from 6,000 to 10,000 bbl. The Keimir property is now under development and new flowing production is expected. Keimir and Chudaidag, which have been under prospecting for some time, are situated between the steppe lands along the Caspian Sea and Kapetdag mountain ridge. The first flowing well at Turcomanneft was drilled in 1931 and up to 1935 five more flowing wells had been opened. Production has increased gradually from 98,000 bbl. in 1931 to 238,000 bbl. in 1932, 1,100,000 bbl. in 1933, and 1,200,000 bbl. in 1935. During 1933 one well alone produced about 700,000 bbl. of crude in 18 days.

New prospecting for oil is being carried on in the region of Sizran (Middle Volga Plains) where signs of oil have been found at 2,000 ft. Two wells which have been drilled in the Middle Carbon formations are reported to be of the same tectonic as those found throughout the territory between the Urals and the Volga. Prospecting for oil has also been carried on at Romni and Lubni in the northwestern region of the country. Salt dome formations have been reported and wells drilled have yielded oil at the rate of 140 bbl. per day. All these operations, together with new extensions of old fields and discoveries of new territory, are certain to improve the status of the Soviet oil industry, but it is unlikely that the effect will be felt immediately. In view of the improved showings so far this year, however, and barring any unforeseen reverses in drilling and production, the total crude production for 1936 is likely to exceed the total figure for last year. It may, in fact, approach the 200,000,000 bbl. mark, which would be an all-time Soviet record. The Izberbash and Pirsagat

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properties of the Caucasus and the new discoveries in the Urals and Western Siberia, details of which were reported in the June issue of WORLD PETROLEUM, are not likely to contribute as yet toward substantially increasing the total Soviet crude production for 1936. Preliminary preparation of the fields such as building roads and bringing in supplies, in addition to the unforeseen delays which will undoubtedly be encountered, make it unwise to rely upon these areas for any substantial production before 1937. Furthermore, any possible production from these new regions during the current year will only serve to counterbalance reverses or shortcomings in old and existing fields now under operation.

Soviet drillers have recently reported further gains in speed and distance drilled. At Baku, Grozni, Maikop and other Soviet fields individual wells have been drilled in record time, the commercial drilling speed equaling 4,500 ft. per table per month. Such achievements, of course, indicate the possibilities, but are not as yet conclusive for routine operation. ZA INDUSTRIALIZATIU of May 9 states:

"The Stakhanoff movement in Soviet drilling has made history. Drilling speeds have reached all-time records. While in 1935 a speed of 2,000 ft. per table per month was considered the limit for Soviet operation, Stakhanovittes at Baku, Grozni and Maikop have drilled 2,500 and 3,500 ft. per month and have shown that Soviet operators are willing to reach American standards of field practice. During April and May all previous records were surpassed by from 38 to 80 percent, a performance made possible by the proper selection of teams who knew how to utilize equipment and time, thus eliminating inefficiency and waste. In spite of all these successes in drilling, however, Soviet operators still have a great deal to learn about actually lifting the oil above the surface. It would appear as if all the gains made by Soviet drillers are subsequently lost by production operators, due to breakdowns and inability to start operation of wells after they are drilled. Thousands of wells are idle and wells under compressor or pumping operation are producing much below expectations. The Stakhanoff tempo, mastered in drilling, still has a long way to go in production."

Refinery construction planned for 1936 is progressing satisfactorily. At the Baku-Stalin group of plants, where five new pipe stills are scheduled to be completed by the end of the year, two units have been erected and tested, of which one unit already has been put on steam producing 50 percent of light products from crude. The other unit will probably come on stream shortly. Both refineries have an annual capacity of 14,000,000 bbl. Three more refineries are to be completed during the year and will thus increase Baku refining capacities to about 115,500,000 bbl. of crude a year. All the five pipe stills are of Soviet domestic design and construction.

Construction planned for 1936 also includes 16 cracking units with a total charging capacity of about 22,500,000 bbl. per annum. Thus far 10 units, with approximately 10,500,000 bbl. charging capacity, have been completed.

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